Chapter 3
AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND MITIGATION STRATEGIES

3.0 INTRODUCTION

3.0.1 Purpose and Content of this Chapter

This purpose of this chapter is to describe existing environmental conditions in the areas that would be affected by the No Project Alternative and the Rail Improvements Alternative; evaluate potential environmental impacts associated with the No Project Alternative and with constructing and operating the Rail Improvements Alternative; and present potential program-level mitigation strategies to avoid or reduce those impacts. The analysis presented in this chapter addresses the general effects of a program of actions that would make up the proposed LOSSAN Rail Corridor Improvements project. This chapter describes the general differences in potential environmental consequences between the No Project Alternative and the Rail Improvements Alternative. The analysis also identifies key differences between the potential impacts associated with the various rail alignment options and station improvements, to support the selection of preferred alignment options for the LOSSAN rail corridor.

3.0.2 How this Chapter is Organized

This chapter is organized into sections by resource topic. The resource topics are grouped as follows.

- Transportation and related topics (air quality; noise and vibration; and energy).
- Human environment (land use and community impacts; parklands; aesthetics and visual resources; socioeconomics; utilities and public services; and hazardous materials/ wastes).
- Cultural resources (archaeological resources, historic properties) and paleontological resources.
- Natural environment (geology and seismic hazards; hydrology and water resources; and biological resources, including wetlands).
- Section 4(f) and 6(f) resources (certain types of publicly owned parklands, recreation areas, wildlife/waterfowl refuges, and historic sites).

Each resource topic section contains the following information.

- *Methods of Evaluation*
- *Regulatory Requirements.*
- *Affected Environment*
- *Environmental Consequences*
- *Mitigation Strategies*
- *Subsequent Analysis*

The *Methods of Evaluation and Regulatory Requirements* discussions for each resource topic describe the assumptions, approach for evaluation, and rating scheme used to identify potential impacts as significant (potentially requiring mitigation), and identify the relevant statutes and CEQA, NEPA, or regulatory agency guidelines relevant to future project approvals or decisions for that resource topic. The methods of impact evaluation were developed with input from state and federal resource agencies.

The *Affected Environment* summarizes the information that provides the basis for analysis of potential environmental impacts on each environmental resource. Existing conditions as of 2003 are summarized based on the program-level, GIS data obtained for the analysis. The technical studies prepared for each resource area provided key information for the preparation of the *Affected Environment* discussions.

The *Environmental Consequences* discussions describe the potential environmental impacts (both adverse and beneficial) of the Rail Improvement in comparison to the No Project Alternative. Each discussion begins by comparing existing conditions with 2020 No Project conditions to describe the consequences of No Project and how environmental conditions are expected to change during the timeframe required to fully construct the proposed Rail Improvement. Existing (2003) conditions were used as a proxy for 2020 No Project conditions where 2020 baseline information was unavailable, could not be projected, or would be overly speculative. Using 2020 No Project conditions as a basis for comparison, the analysis of impacts then addresses direct and indirect impacts for the proposed Rail Improvement, as well as potential cumulative impacts. Measures that already have been included as part of the proposed Rail Improvement to reduce or avoid potential environmental impacts were incorporated into this analysis; examples include: locating the alignment options within existing transportation corridors, tunneling to avoid surface disruption in sensitive areas such as coastal beaches, and designing new rail bridges so that there would be no net increase in the footprint of rail infrastructure within coastal lagoons. The impact analysis summarizes specific resource data for each alignment option, and then compares options with one another within each rail segment, with a focus on any substantive differences between options.

The *Mitigation Strategies* describes potential mitigation approaches that can be identified at a program level for use to avoid, minimize, or reduce any potentially significant environmental impacts.

Finally, each resource topic section includes a *Subsequent Analysis* discussion summarizing directions for more detailed study during project-level environmental review and documentation should the Rail Improvement be selected through the program environmental process.

Many sources were used in the preparation of this document. References to these sources are provided in Chapter 11. In some cases to clarify a particular source, specific references are called out in the text.

3.1 TRAFFIC AND CIRCULATION

This section describes the existing traffic and circulation conditions in the transportation study area and identifies the potential traffic, transit, circulation, and parking impacts of each alignment option and station option.

3.1.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

NEPA and CEQA both require that potential impacts of a proposed project on the traffic, transit, and circulation of the affected area must be examined as part of the EIR/EIS process. Under CEQA, a proposed project should be analyzed for the potential effects listed below (California Department of Transportation 2003).

- An increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in the number of vehicle trips, the volume-to-capacity [V/C][1] ratio on roads, or congestion at intersections).
- Either individually or cumulatively exceeding a level of service (LOS)[2] standard established by the county congestion management agency for designated roads or highways.
- A substantial increase in hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment).
- Inadequate parking capacity.
- Inadequate emergency access.
- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g. bus turnouts, bicycle racks).
- Rail, waterborne, or air traffic impacts.

Volume-to-capacity ratios and level of service are defined quantitatively in Table 3.1-1.

Given the scale of the proposed rail corridor improvements, virtually all of the criteria mentioned above would be potentially affected by the No-Project and Rail Improvement Alternatives. For this analysis this program-level document focused on the criteria below.

- Traffic and level of service analysis of the following elements.
  - Intercity highway segments.
  - Primary highways/roadways accessing stations.
- Potential impacts on transit, goods movement, and parking for each of the regional corridors and proposed stations and airports.

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[1] The volume-to-capacity (V/C) ratio is the number of vehicles that travel on a transportation facility divided by the full vehicular capacity of that facility (the number of vehicles the facility was designed to convey).

[2] Level of service is a qualitative measure used to describe the condition of traffic flow, ranging from excellent conditions at level of service (LOS) A to overloaded conditions at LOS F. LOS D is typically recognized as an acceptable service level in urban areas. The definition for each level of service for signalized intersections is based on the V/C ratio.

Table 3.1-1
Level of Service and Volume-to-Capacity Ratio Definition

Level of Service	Volume-to-Capacity Ratio	Definition
A	0.000−0.600	EXCELLENT. No vehicle waits longer than one red light and no approach phase is fully used.
B	0.601−0.700	VERY GOOD. An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	0.701−0.800	GOOD. Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	0.801−0.900	FAIR. Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	0.901−1.000	POOR. Represents the maximum vehicles that intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	>1.000	FAILURE. Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.

Source: Transportation Research Board 1980

B. METHOD OF EVALUATION OF IMPACTS

The traffic, transit, circulation, and parking analyses for this Program EIR/EIS focused on a broad comparison of potential impacts on traffic, transit, circulation, and parking around stations for the Rail Improvement Alternative. The potential impacts for each of these alternatives were compared to the No-Project Alternative.

Highway, roadways, passenger transportation services (e.g. bus, rail, intermodal, and transit facilities), goods movements, and parking issues were evaluated in this analysis. Transportation facilities, highways, and roadways included in the analysis serve as the primary means of existing (or planned future) access to existing and proposed rail stations. In addition, these facilities are within 1 mi (1.6 km) of the proposed suburban rail stations, 0.25 mi (0.40 km) of downtown stations, or are key capacity-constraint points on major routes along intercity corridors.

Although this level of analysis is appropriate for a program-level environmental document, variations in traffic conditions on smaller transportation facilities such as arterials and roadways are not included in the study area. Many of these smaller facilities are currently congested, and their operation is projected to worsen under the No-Project Alternative. Operation of these facilities could indirectly benefit from implementation of the Rail Improvement Alternative. The capacity improvements of the Rail Improvement Alternative could reduce demand such that long-distance trips would not be forced onto local streets. The potential impact of an improved rail system on these smaller facilities would be examined as part of any subsequent and more detailed project-level environmental analyses.

For this program level document, initial analysis included identifying primary routes to be considered, with highways designated in the No-Project Alternative and all modes of access to the station areas in the Rail Improvement Alternative, respectively. The primary routes and modes of access for the stations considered assumptions for distribution of trips by direction.

Once primary routes were identified, screenlines or cordons combining segments of the primary routes that reasonably represent locations for evaluating the aggregate baseline traffic and public passenger transportation conditions (using data for 2002, 2020, or other similar years as available) in the a.m. peak hour were selected. Only a.m. peak hours were selected because they were seen as sufficient for a program level analysis. Both a.m. and p.m. will be analyzed during project specific evaluations. The use of screenlines or cordons is necessitated by the scale of this analysis with its requirement to evaluate roadway conditions throughout the region. A more detailed analytical framework must necessarily be reserved for future analyses of individual projects.

Screenlines, especially on intercity highway links, have been selected to represent typical a.m. peak-hour conditions. The data used in the evaluation of traffic volumes and capacities at the screenlines therefore are typical values based on averages over time and represented in traffic forecasting tools used by the regional transportation planning agencies. As such, the conditions indicated in the evaluation may not always reflect the experiences of travelers at any particular place at any specific time. For example, localized capacity restrictions (e.g. bottlenecks at a given interchange) are not well represented in those regional traffic models. In addition, incidents on the road such as accidents and vehicle breakdowns (non-recurring congestion) are not represented in regional traffic models. This unpredictable type of incident is responsible for the majority of congestion in urban highway networks. The result of these limitations of the methodology and data used in this analysis is that many times the level of service or average speed shown in the evaluation may be more optimistic than what would actually be experienced on the roadway under the forecasted conditions. Thus, it is important to consider the differences between the alternatives compared rather than focus on the absolute value of the indicators (i.e., volume to capacity or level of service).

Baseline conditions were defined using the methodology below.

- Intercity Screenlines: Baseline conditions (2002, 2020) were established for intercity highway segments based on available counts of existing weekday a.m. peak hour traffic volumes and projected annual growth rates. This process involved a comparison of existing V/C to determine level of service at link level.

- Station Cordons: Baseline (2002 and 2020 data, as available) ratios of demand to capacity across each cordon for roadways (not intersections) were established for the weekday a.m. peak hour using 2000 HCM standards for capacity. (Transportation Research Board 2000)

- Transit Access: Baseline conditions were established through an inventory of available public transportation services at and adjacent to the stations.

- Goods Movement: Baseline conditions (2002, 2020) for goods movement (truck freight) weekday a.m. peak hour for locations in the area were identified as critical by regional goods movement studies.

- Parking at or near Stations: Descriptions of parking conditions are based on 2002 parking reserves, local plans for major parking expansion, and adequacy of local parking codes for meeting No-Project growth in demand.

In this traffic study, only the High-Build scenario of the Rail Improvements Alternative was analyzed. The options presented in this scenario demonstrated the most conservative numbers, which represented the highest benefits and impacts to the transportation system. Additionally, the station area impacts were determined to be similar to those in the Low-Build scenario. A discussion outlining the qualitative differences between these two scenarios is provided in section 3.1.4.

Trips associated with the Rail Improvements Alternative were determined ("generated") and distributed onto the network. To be conservative in this analysis, the high-end trip generation was used based on calculations performed for the LOSSAN corridor by the California High Speed Rail Authority, which assumed that intercity (Amtrak) trains would act as a feeder service to the statewide high-speed train system between Los Angeles, Sacramento and the Bay Area. This method calculated the trip generation by adding to baseline volumes the forecasted 2020 demand for a system that served intercity trips and feeds a high-speed train system, plus local trips in 2020 generated by project-related development (as data are available) and trips due to induced growth. These additional trips were distributed to the identified screenlines or cordons (roadway and public transportation) and those trips were added to the appropriate baseline volumes for each screenline or cordon. Next, the additional trips were distributed for selected segments/links on primary regional routes and modes of access to stations and similar facilities by adding No-Project volumes obtained from 2020 forecasts (from regional and local agencies), and 2020 travel demand generated by alternatives, to the key accessing facilities (roadways, transit links). This distribution was done at a screenline level to reduce the subjectivity of assigning trips to specific facilities. Methodology for this process is detailed below.

- For each screenline or cordon, new ratios of demand-to-capacity were calculated. Demand is the baseline volumes plus additional trip generation by the Rail Improvement Alternative.
- Future No-Project link capacity conditions were established through available plans from local and regional agencies, and based on the fiscally constrained element of the relevant regional transportation plan (RTP).
- Link-level analysis of impacts was performed to roadways for weekday a.m. peak-hour conditions. Capacity levels were based on the 2000 HCM methodologies.
- Future roadway V/C on selected segments compared future volumes with/without alternatives with future capacity determined. Future V/C with/without the alternatives was analyzed. This assessment was performed at a cordon level, aggregating the V/C on all major facilities accessing the stations.
- Cordon-level analysis was also performed for public transportation services serving the stations or airports, based on weekday a.m. peak-hour service headway and capacity conditions.

- Impacts were determined by comparing future load factors or service headway requirements with existing levels, No-Project levels (as specified in relevant RTPs), and levels demanded by the Rail Improvements Alternative.
- Goods movement impacts were determined through an assessment of the net impact of project alternatives on the corridor.

Summary tables were then completed that identified impacts on highways/roadways (at screenline), public transportation services, goods movement, and parking facilities. The impacts are described and ranked as high, medium, or low in the summary tables in the appendix of this section, according to the potential extent of change to traffic, transit, circulation, and parking and described in terms of LOS A to LOS F for traffic impacts.

The final step included the identification of mitigation strategies for avoidance of potential impacts related to traffic, circulation, and parking. Most mitigation measures involve subsequent analysis of traffic, circulation, or parking in the next phase of work.

3.1.2 Affected Environment

A. STUDY AREA DEFINED

The transportation study area is defined as the primary highways and roadways that: 1) serve as the primary means of access to existing and proposed rail stations; and 2) are within 1.0 mile (mi) (1.6 kilometers [km]) of existing or proposed rail stations and includes the coastal areas of southern California between Los Angeles and San Diego, following the existing LOSSAN rail corridor.

Only three intercity highways in the region connect the metropolitan areas of Los Angeles and San Diego County, these include Interstate 15, Interstate 5, and State Route 1. Of these three routes, only Interstate 5 provides a continuous and direct connection between Los Angeles and San Diego through Orange County. Because of this, Interstate 5 has been identified as the primary route between Los Angeles Union Station (LAUS) and San Diego.

B. GENERAL DISCUSSION OF RESOURCES

In general, traffic conditions throughout the study area are poor in terms of congestion levels (e.g. travel delays), particularly during the peak periods. According to nationwide studies conducted by the Texas Transportation Institute, the Los Angeles urban area experiences the highest congestion levels in the country. Highways are heavily congested during both the morning and evening peak hours in and around the urban centers of Los Angeles, Orange County, and San Diego. This congestion is caused mostly by regional and urban commute traffic. Commute trips (to and from work) make up the majority of highway trips during the peak periods; the intercity trips considered in this analysis represent only a small proportion of highway traffic. The Southern California Association of Governments (SCAG) has estimated that, during morning peak-hour traffic in some of the most congested corridors in southern California, the average speed is less than 20 miles per hour (mph) in the congested direction. In 2002, traffic congestion costs motorists in California $20.4 billion annually in lost time and fuel.

Traffic conditions throughout Southern California are expected to worsen, and only limited improvements to transportation facilities are funded and programmed for implementation by 2020. Steadily increasing regional and urban traffic affects intercity commutes by delaying travelers where capacity is constrained. Intercity travel that competes with regional and intraregional travel for use of the same facilities is directly affected by these conditions.

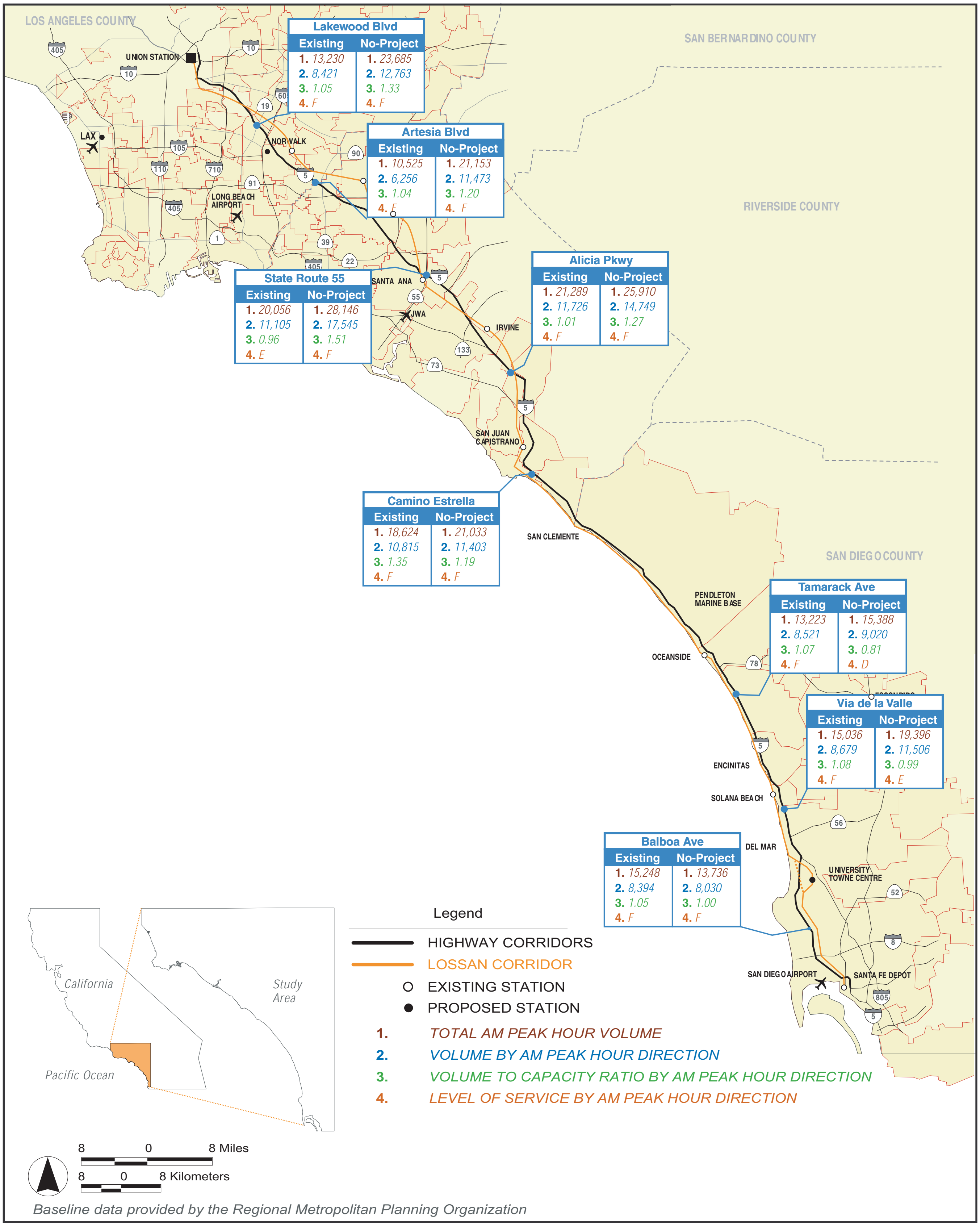
3.1.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO-PROJECT ALTERNATIVE

The existing condition is the transportation infrastructure that exists in 2003 and its associated levels of service. The No-Project Alternative includes the existing infrastructure, plus the implementation of funded and programmed transportation improvements that will be operational by 2020 and the projected level or service of that infrastructure in 2020. Impacts on intercity highways are analyzed in terms of V/C ratio and corresponding level of service. Impacts on transit, goods movement, and parking are harder to quantify but include potential impacts such as full parking lots at stations, and are assigned a low, medium, or high rating corresponding to the estimated level of potential impact.

Under the No-Project Alternative, existing traffic conditions are projected to deteriorate along most highway segments and near the stations in the study area. As shown in Figure 3.1-1, all of the 8 intercity highway segments analyzed would have a high V/C ratio under the No-Project Alternative. In general, traffic congestion is projected to increase because travel is expected to increase by 2 to 3% per year along some segments. The No-Project Alternative does not provide infrastructure improvements sufficient to address the projected growth in highway travel and the exponential increase of commute trips within the urban areas. In most cases, the potential impact would manifest itself as deteriorating levels of service on highway segments and local streets or extended peak-period congestion on highways that already operate at LOS F (i.e., the a.m. peak period would extend from 2 hours to 4 hours).

Exceptions to these projected worsening conditions are expected to occur in certain locations along the corridor, where not only does the V/C ratio not increase from the existing condition, but in fact becomes lower, providing a somewhat higher level of service. The reason for this, specifically around station areas, differs depending on the county. San Diego County's Regional Transportation Plan assumes a strong public transportation base over the next 20 to 30 years; this assumption is reflected heavily in their forecasted traffic models. In addition to this, the forecasted models assume a much higher capacity for Interstate 5 due to programmed improvements, allowing for a higher LOS, even though the volume of vehicles traveling over the highway is increasing. Table 3.1-2 summarizes the differences in V/C ratios and LOS along Interstate 5 between the existing and No-Project conditions.



Source : June, 2004 - *California Department of Transportation*

Caltrans

U.S. Department of Transportation
Federal Railroad Administration

FIGURE 3.1-1

Year 2020 No Build Alternative

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

Table 3.1-2
Change in Traffic Congestion or Intercity Highway Segments
Existing Conditions Compared to the No-Project Alternative

Selected Screenlines Along Interstate 5	Existing V/C, LOS	No-Project V/C, LOS	% Change from Existing
Los Angeles County			
Lakewood Blvd (City of Downey)	1.05 F	1.33 F	+21.1%
Artesia Blvd (City of La Mirada)	1.04 F	1.20 F	+15.8%
Orange County			
State Route 55 (City of Tustin)	0.96 E	1.51 F	+36.4%
Alicia Pkwy (City of Mission Viejo)	1.19 F	1.44 F	+17.3%
Camino Estrella (City of San Clemente)	1.35 F	1.19 F	- 11.9%
San Diego County			
Tamarack Ave (City of Carlsbad)	1.07 F	0.81 D	- 24.3%
Via De La Valle (City of San Diego)	1.08 F	0.99 E	- 8.3%
Balboa Ave (City of San Diego)	1.05 F	1.00 F	- 4.8%

Summary descriptions of the existing and No-Project traffic, transit, circulation, and parking conditions are provided below. Traffic and circulation in station areas are analyzed for both the No-Project and Rail Improvements Alternative. For a more detailed discussion of traffic data in the region under existing, No-Project, and Rail Improvements Alternative, see the LOSSAN Region technical report[3].

Intercity Highway Segments

Under existing conditions, seven of the eight locations analyzed are operating at LOS F, and the remaining location (I-5 at SR-55) is operating at LOS E with a V/C ratio of 0.96, approaching LOS F (V/C of 1.0 or more), as shown in Table 3.1-2. These conditions are not expected to improve under the No-Project Alternative; on average, V/C ratios are projected to increase by 12% at these locations, reflecting more severe congestion and longer congested peak periods. There are three exceptions to this projected condition under the No-Project Alternative: significant freeway and transit system expansions are planned along I-5 in San Diego County, resulting in a lower LOS at the screenlines of Tamarack Avenue and Via de la Valle, while the completion of the SR-241 Toll Road in Orange County will assist in improving the LOS along I-5 through San Clemente, as

[3] California High Speed Rail Authority, *Traffic, Transit, Circulation & Parking Technical Evaluation*, 2004

shown by the screenline at Camino Estrella. These improvements will improve the existing LOS F condition to LOS D and E, respectively.

Intercity Rail Stations

Traffic conditions are expected to worsen at the station sites, with the exception of four stations, where funded roadway improvements will result in improved conditions under the No-Project Alternative. The station sites where improvements are expected are Norwalk Station (V/C ratio would improve from 0.71 to 0.70, LOS C under both conditions), the Fullerton Transportation Center (0.84 to 0.77, LOS D to LOS C), the Anaheim Transportation Center (0.55 to 0.50, LOS A under both conditions), and the proposed University Towne Centre Station (0.68 to 0.65, LOS B under both conditions).

Transit, Goods Movement, and Parking

Based on the existing number of transit routes, frequencies, and span of service, no significant impact on public transit services is projected if no significant improvements to existing public transit service were provided under No-Project.

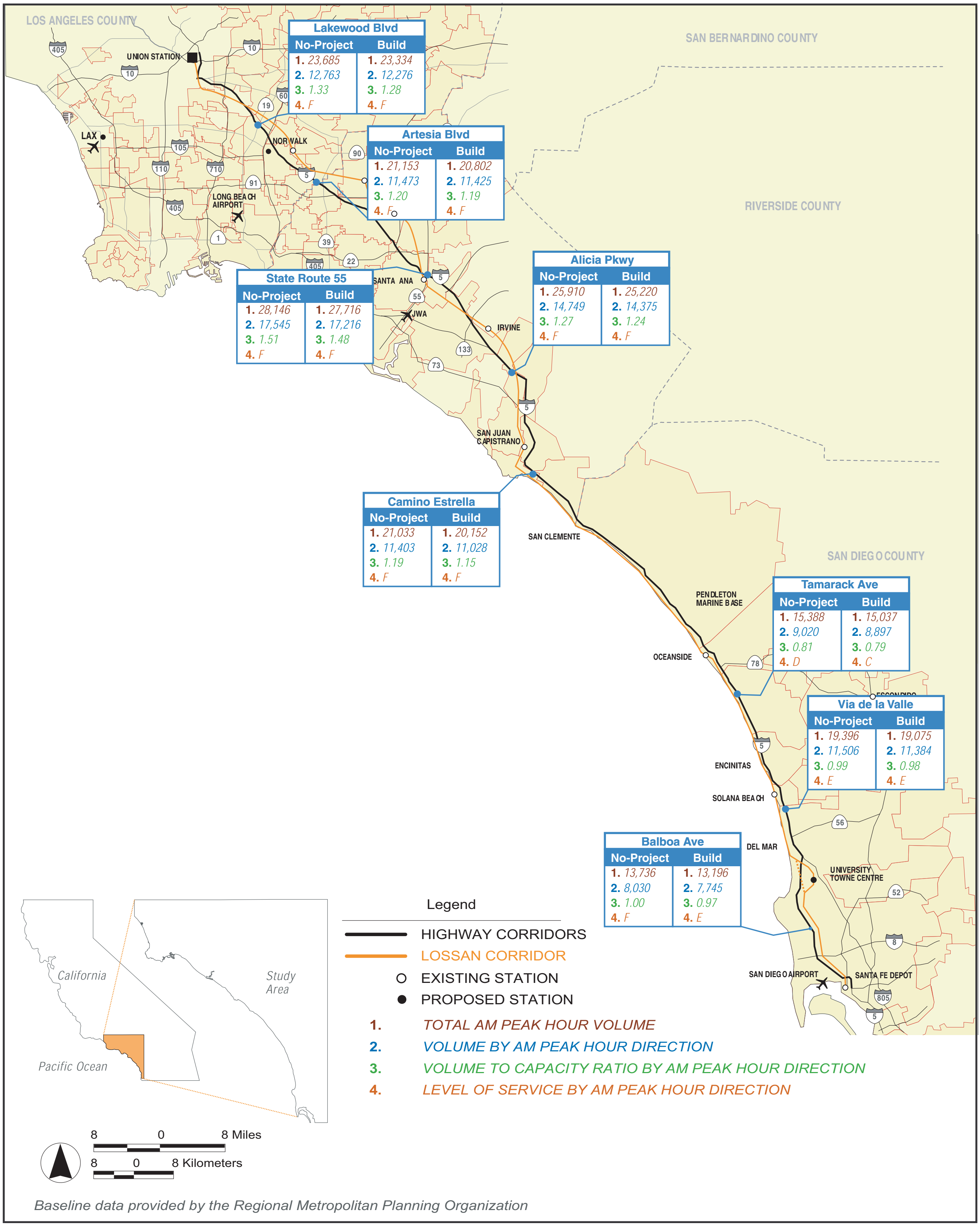
Most delay impacts on goods movement would occur in Los Angeles County and north Orange County, where heavy freight received at the Ports of Los Angeles and Long Beach exits the region en route to destinations throughout the nation. Potential negative impacts on goods movement in south Orange County are projected to occur because the higher vehicular traffic on I 5, which is forecast under the No-Project Alternative, would not be met by a corresponding increase in the capacity of transportation facilities.

With the exception of the Norwalk and San Juan Capistrano Stations, no parking impacts are projected under the No-Project Alternative. The Norwalk Station is projected to have medium parking impacts due to land constraints potentially inhibiting the construction of additional parking spaces, and the San Juan Capistrano Station is projected to have high parking impacts, because there is little land around the existing station area that can be developed to meet the projected parking demand due to the proximity of historical resources. [4]

B. NO-PROJECT ALTERNATIVE COMPARED TO THE RAIL IMPROVEMENTS ALTERNATIVE

The No-Project Alternative represents the future baseline condition. It is assumed that any improvements associated with the proposed Rail Improvements Alternative would be in addition to the No-Project condition. As shown in Figure 3.1-2, on the following page, the proposed Rail Improvements Alternative would improve traffic at the intercity screenlines compared to the No-Project Alternative. Long-term potential impacts related to the No-Project Alternative could potentially be alleviated by the Rail Improvements Alternative through the diversion of some automobile trips to the intercity rail system.

[4] California High Speed Rail Authority, *Traffic, Transit, Circulation and Parking Technical Evaluation*, May 2003



Source : June, 2004 - *California Department of Transportation*

U.S. Department of Transportation
Federal Railroad Administration

Caltrans

FIGURE 3.1-2

Year 2020 Build Alternative

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

As summarized in Table 3.1-3, the average V/C ratio improvement is anticipated to be between 1% and 4% under the Rail Improvements Alternative. The differences within the region are directly related to the volume of demand. Segments with less demand will experience greater changes in levels of service with the proposed improvements compared to segments with higher demand.

Table 3.1-3
Change in Traffic Congestion or Intercity Highway Segments
No-Project Conditions Compared to the Rail Improvements Alternative

Selected Screenlines Along Interstate 5	No-Project V/C, LOS	Rail Improvements Alternative V/C, LOS	% Change from No-Project
Los Angeles County			
Lakewood Blvd (City of Downey)	1.33 F	1.28 F	- 3.8%
Artesia Blvd (City of La Mirada)	1.20 F	1.19 F	- 0.8%
Orange County			
State Route 55 (City of Tustin)	1.51 E	1.48 F	- 2.0%
Alicia Pkwy (City of Mission Viejo)	1.44 F	1.41 F	- 2.1%
Camino Estrella (City of San Clemente)	1.19 F	1.15 F	- 3.4%
San Diego County			
Tamarack Ave (City of Carlsbad)	0.81 F	0.79 D	- 2.5%
Via De La Valle (City of San Diego)	0.99 F	0.98 E	- 1.0%
Balboa Ave (City of San Diego)	1.00 F	0.97 F	- 3.0%

The Rail Improvements Alternative would help to reduce the long-term impacts on freeways by providing a viable alternative to the automobile, which could in turn divert some intercity automobile trips to the rail system. It is possible that the improved rail system could attract additional trips which could cause some increased station area traffic and some additional diversion from Interstate 5. It is also possible that increase transportation system capacity with the Rail Improvements Alternative could induce additional trips not accounted for in the Regional Model highway demand.

In addition to helping to improve highway capacity by potentially reducing traffic, the Rail Improvement Alternatives would eliminate traffic delays at existing at-grade crossings along the LOSSAN corridor by grade-separating the crossings. The grade separations would also improve the reliability of both the vehicle trips crossing the rail corridor and the intercity, commuter and freight trips within the corridor.

Overall, as summarized in Table 3.1-3, although highway conditions would improve under the Rail Improvements Alternative, the general conditions would remain at poor levels of service with V/C ratios of more than 1.0, on average, for the region. As discussed above, the conditions shown in the evaluation may not always reflect the experiences of travelers at any particular place at any specific time. For example, localized capacity restrictions (e.g., bottlenecks at a given interchange) are not well represented in regional traffic models. In addition, incidents on the road, such as accidents and vehicle breakdowns, are not represented in the regional traffic models. These non-recurring incidents are unpredictable and are responsible for the majority of congestion on urban highway networks.

Goods movement and transit have some minor regional or local impacts; however on average, the potential effects of the Rail Improvements Alternative would be negligible. Planning provisions were made for parking at station areas under the Rail Improvements Alternative respectively; consequently there should be little effect on the existing parking supplies.

3.1.4 Comparison of Alternatives

This section summarizes key findings comparing the Rail Improvements Alternative to the No-Project Alternative, based on traffic, circulation, and parking. For detailed summary tables associated with this analysis, see Appendix 3.1-A.

Intercity Highway Segments

Under the Rail Improvements Alternative, traffic congestion is projected to improve slightly on the intercity highway segments compared to the No-Project Alternative. The most significant changes would occur on I-5 at Balboa Avenue (in the City of San Diego) and on I-5 at Tamarack Avenue (in the City of Carlsbad), where the level of service would improve from LOS F to LOS E and from LOS D to LOS C, respectively.

Intercity Rail Stations

The Rail Improvements Alternative would cause no significant changes in levels of service or V/C ratios within the station areas compared to No-Project, except at the proposed San Juan Capistrano station, where the level of service would degrade from LOS E to LOS F without further improvement to local roads.

Transit, Goods Movement, and Parking

The Rail Improvements Alternative would cause no significant impacts on public transportation or goods movement compared to the No-Project Alternative.

Except at the Norwalk and San Juan Capistrano stations, parking capacity at each station is projected to meet the demand of travelers under the Rail Improvements Alternative; there would be no significant change compared to No-Project. Under the Rail Improvements Alternative, potential parking impacts could occur at the Norwalk and new Trabuco Creek station in San Juan Capistrano. Impacts at these stations are due to the lack of available land around the station areas to provide sufficient parking capacity. However, the Trabuco Creek station in San Juan Capistrano would be located in close proximity to the downtown parking structure and surface lots and may still be able to utilize these locations to provide for additional parking.

A. ALIGNMENT OPTION COMPARISON

For the purposes of this analysis, one "build" alternative was assumed, as in most cases the differences between the low- and high-build alternatives are minor. However, of the improvements identified for the LOSSAN corridor, three locations present significant differences in alignment options and transportation impacts.

San Juan Capistrano

Two design options exist in the city of San Juan Capistrano, in addition to the "No-Project" (maintaining the existing conditions) option:

I-5 Tunnel

This option would bypass the downtown area of the City of San Juan Capistrano completely by realigning the railroad right-of-way in a bored-tunnel beneath Interstate 5. This option accommodates the possibility of retaining the existing single-track line and service through downtown San Juan Capistrano. However, there would not be an intercity station provided along the I-5 tunnel bypass of San Juan Capistrano.

The benefits and impacts associated with this option include:

- Reduced intercity passenger service to San Juan Capistrano;
- Reduced local traffic related to station parking;
- Increased congestion on Interstate 5 as result of the use of the freeway to access the next nearest station; and
- Increased parking and traffic congestion in Irvine.

Trabuco Creek Cut and Cover Tunnel

This option would realign the existing alignment through San Juan Capistrano's downtown to the west, loosely following the east bank of Trabuco Creek. It would provide a replacement station due west of the existing station.

The benefits and impacts associated with this option include:

- Only access to new station would be from Del Obispo; and
- Limited land for parking, however the existing parking structure and surface lots in downtown could be retained as the distance is between 1,500 and 2,000 feet away from the station along Trabuco Creek.

San Clemente / Dana Point

Two design options exist in the San Clemente/Dana Point area, in addition to the "No-Project" (maintaining the existing conditions) option.

Short Tunnel – I-5

This option would straighten the Dana Point curve, and double-track the corridor along the existing right-of-way until just north of the San Clemente Metrolink station, where the alignment would begin to enter into a trench and then turn inland, tunneling just north of

Avenida Pico, where a new station would be provided in an open trench. The alignment would remain in a twin-bored tunnel beneath the Interstate 5 right-of-way, until rejoining the existing LOSSAN corridor near San Onofre Creek.

The benefits and impacts associated with this option include:

- The relocation and consolidation of the two existing San Clemente rail stations into one; and
- Beach access would become more difficult from the stations, however easier access to the freeway would be provided.

Long Split Tunnel - with Station

This option is comprised of two tunnels located beneath the right-of-way of Interstate 5 between Avenida Aeropuerto in San Juan Capistrano and San Onofre Creek. The split in the tunnels would occur at Avenida Pico, allowing for a new station in San Clemente.

The benefits and impacts associated with this option include:

- The relocation and consolidation of the two existing San Clemente rail stations into one; and
- Beach access would become more difficult from the stations, however easier access to the freeway would be provided.
- Pier Bowl area of San Clemente would be relieved of station traffic impacts.

University Towne Centre

Two design options exist in the University Towne Centre (UTC) area, in addition to the “No-Project” (maintaining the existing conditions) option.

University Towne Centre Tunnel

This option would bypass the existing curves through Sorrento Valley and Miramar by tunneling under the University Towne Centre business and shopping complex, roughly following beneath the right-of-way of Genesee Avenue. As part of this option, an underground multi-modal facility is planned that would offer a new intercity passenger rail stop, as well as provide for new Coaster commuter rail station and provide increased multi-modal connectivity with transit and Bus Rapid Transit/Light Rail services planned for the University City area, which is a major employment center and consists of dense residential neighborhoods located near the campus of the University of California, San Diego (UCSD).

The benefits and impacts associated with this option include:

- A new station that would serve the businesses in and around Sorrento Valley and the University;
- Increase in traffic impacts due to the new station; and
- Relieve traffic congestion at the Solana Beach and downtown San Diego stations.

Interstate 5 Tunnel

This option would bypass the existing curves through Sorrento Valley and Miramar by tunneling beneath the right-of-way of Interstate 5. This option would deviate from the existing right-of-way near the Sorrento Valley Coaster station and exit into a covered trench at the western edge of Rose Canyon.

The benefits and impacts associated with this option include:

- No additional station would be added, potentially increasing the traffic impacts at both the Solana Beach and downtown San Diego stations.

3.1.5 Mitigation Strategies

Currently, regional planning agencies and the counties and cities in the region have considerable flexibility to deal with identified traffic, transit, and parking impacts. The Department could participate in developing potential construction and operational mitigation measures in consultation with state, federal, regional and local governments and affected transit agencies during project level reviews

Potential mitigation measures could be developed to improve the flow of intercity travel on the primary routes and access to the stations. These improvements would be based on the forecast capacity deficiencies identified for the No-Project and Rail Improvements Alternative and could possibly employ some of the following approaches.

- Transportation System Management (TSM)/Signal Optimization (including retiming, rephrasing, and signal optimization); other measures may include turn prohibitions, use of one-way streets, and traffic diversion to alternate routes.
- Local spot widening of curves that allows for geometric improvements without significant right-of-way acquisition.
- Major intersection improvements (full lane widening), which require significant right-of-way acquisition to accommodate additional left-turn and/or through lanes.

V/C ratios on the major intercity routes identified in the system screenline analysis show the desirability of more capacity on several freeway segments under all alternatives. When considering measures for traffic mitigation, the increase in automobile congestion and lowered vehicle flows that would be caused by the Rail Improvements Alternative would be studied at the project level analysis in the context of providing an improved transportation system and would consider total passenger flow versus vehicle flow in the study area if the Rail Improvements Alternative is selected.

Project level environmental review would include consultation and coordination with public transit services in order to encourage the provision of adequate bus feeder routes to serve proposed station areas which could mitigate potential transit impacts.

3.1.6 Subsequent Analysis

If the Rail Improvements Alternative is selected, subsequent multimodal access and circulation studies could be appropriate at all station areas as plans for alignments, stations, and operations are refined. Additional environmental analysis would be required in conjunction with these studies to ascertain the exact locations of potential project-generated traffic impacts and potential parking demand impacts. Station area circulation studies would be expected as part of project-level environmental documentation.

3.2 TRAVEL CONDITIONS

This section describes existing conditions and describes the potential of the No-Project Alternative (No-Project) and Rail Improvements Alternative to affect travel conditions. Automobiles currently carry more than 98%[1] of intercity trips within the study area, and together with the rail mode, are therefore the focus of this section. For this analysis travel conditions are defined as the experience, quality, sustainability, safety, reliability, and cost of intercity travel within the study area. Travel factors were developed based on the purpose and need (Chapter 1) for the proposed incremental improvements, and are used to evaluate the relative impact of proposed changes to the transportation system for each of the alternatives.

3.2.1 METHODS OF EVALUATION

A. METHOD OF EVALUATION OF IMPACTS

The overall method used to evaluate travel conditions is described below. To evaluate the relative differences in travel conditions that would result from implementation of the alternatives, six travel factors were considered that relate directly to the purpose and need and the goals and objectives defined in Chapter 1. These factors are listed below.

- Travel time
- Reliability
- Safety
- Connectivity (modal)
- Sustainable capacity
- Passenger Cost

Travel Time

Travel time is the total time required to complete a journey. With the exception of the automobile, intercity transportation options require multiple modes to complete a trip. Most people acknowledge that a train trip is not just the time spent on the train (the line-haul portion of the trip), but also includes the time required to travel to the station, check in, board the train, and travel to their final destination. The total travel time of a mode is also dependent on its reliability. If a mode is unreliable, a traveler must allow more time to complete a trip, effectively lengthening the total travel time.

Reliability

Reliability is the delivery of predictable and consistent travel times and is a key factor in attracting passengers to use a particular mode of travel. Travel time and reliability directly affect productivity, as they determine the ease and speed with which workers and products arrive at their destinations. Greater travel demand on capacity-constrained facilities results in further congestion and is one of the primary reasons for longer travel times. Reliability is primarily a function of unexpected delays due to many factors

[1] California High Speed Rail Authority, *Los Angeles to San Diego via Orange County Program EIR/EIS,* February 2004

including traffic congestion, accidents, mechanical breakdowns, roadwork, and inclement weather.

Safety

Projected growth in the movement of people and goods in Southern California by road underscores the need for improved travel safety. National and statewide statistics indicate that the rate of fatality or serious injury by private motor vehicle is increasing, primarily because more people are traveling by this mode.

Connectivity

Connections between modes of transportation are a significant element in the development and operation of a successful total transportation system. It is important to consider the passengers' final destination in order to be competitive with the automobile. The ability to transfer easily between modes and the frequency of service are additional key factors that can determine a traveler's modal choice. Under existing conditions and No-Project, alternative intercity modal connections are limited and the connections and services available are fragmented and not provided as an integrated system with coordinated fares, schedules, and amenities. In addition to travel time improvements and improved reliability, it is also important to enhance local bus connections, implementing infrastructure improvements to support this, develop marketing strategies and incentives that will encourage alternative transportation use.

Sustainable Capacity

Sustainable capacity is a measure of the transportation system's capability to meet projected demand without the need to develop additional infrastructure. The current Southern California transportation system is stressed beyond capacity in many places and for considerable periods of the day. As demand increases without sufficient capacity, the severity of the congestion will increase and result in more frequent delays and longer peak travel periods throughout the day. This demand-capacity imbalance will worsen over time as system use increases. As a result, the transportation system will lose the ability to absorb short-term or long-term demand increases and become increasingly inflexible because of the lack of capacity.

The six travel factors are summarized in Table 3.2-1. These travel factors are used to evaluate the relative difference between the No-Project and Rail Improvements Alternatives both qualitatively and quantitatively. The method by which the travel factors have been applied to the alternatives is summarized in Table 3.2-2. Each of the travel factors is described in greater detail as they are applied in the potential environmental consequences of travel conditions discussion.

In general, the No-Project Alternative would include the same intercity travel modes that are available under existing conditions, which are the automobile, intercity bus, and conventional rail as it exists today. The intent of the environmental analysis performed in this Program EIR/EIS is to broadly assess the highest potential level of impact. Therefore, the high-end improvements for the LOSSAN Corridor are used to describe the operations and required facilities for the proposed improvements. However, in a few areas where the high-end forecast produced the lowest impacts or highest benefit, analysis of conditions based on the low-end improvements is also included.

Table 3.2-1
Relation of Travel Factors and Purpose and Need/Objectives

	Travel Factors					
	Connectivity	**Travel Time**	**Reliability**	**Safety**	**Sustainable Capacity**	**Passenger Cost**
Project Purpose						
Increase the cost-effectiveness of the rail service	X	X	X			X
Increase capacity on existing routes					X	
Reduce running times		X	X		X	
Improve the safety of the rail service			X	X		
Project Need						
Future growth in travel demand		X	X		X	X
Capacity constraints		X			X	
Reliability	X	X	X		X	
Safety			X	X		
Air Quality	X				X	
Environmental Concerns					X	
X = Directly applies						

Table 3.2-2
Transportation Factors

Typology	Description	Measurement
Travel Time	Total door-to-door travel time	Total travel time including access and in-vehicle times
Reliability	Ability and perception to arrive at the destination on-time	Accidents Inclement weather Transportation-related construction Volume variation Special events Traffic control devices and procedures Base capacity Vehicle availability
Safety	Loss of life or injury	Comparison of safety performance characteristics by mode (operator, vehicle and environment)
Connectivity	Transportation options that connect to other systems and destinations	*Modal* Number of intermodal connections and options, and frequency of service provided by each alternative
Sustainable capacity	Ability to accommodate additional demand beyond the design demand	Amount of additional infrastructure required to meet a threshold demand above and beyond the design demand
Passenger cost	One-way travel costs	Total costs including fares and other costs for intercity travel by mode
Source: Parsons Brinckerhoff 2003		

3.2.2 AFFECTED ENVIRONMENT

A. STUDY AREA DEFINED

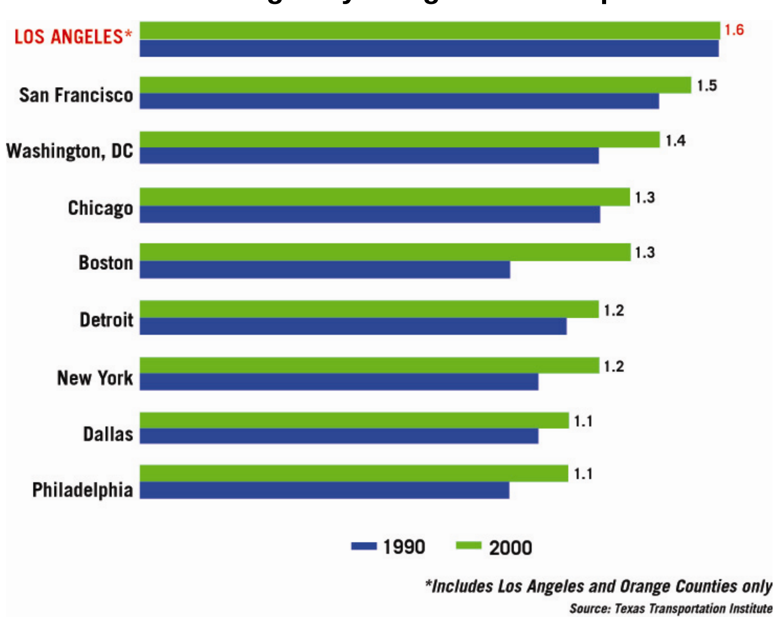
This program-level analysis of travel conditions and potential impacts does not measure the specific potential impact to individual transportation facilities (e.g., a transit line or highway). Rather, travel conditions have been evaluated for the total project area and regional level. Specific examples of representative travel conditions in the corridor for a specific highway or rail facility are identified where possible. The study area for this analysis of travel conditions encompasses the cities within Los Angeles, Orange and San Diego Counties along the existing rail corridor between downtown Los Angeles and downtown San Diego.

B. GENERAL DISCUSSION OF TRAVEL CONDITIONS

For travel conditions, the affected environment is Southern California's intercity travel network, which consists of two main components: highways and rail. Of these two, automobiles currently carry over 98% of intercity trips, and are therefore the focus of this section.

The highway system is congested near and around urban centers (e.g., Los Angeles, Central Orange County and San Diego) and in suburban communities (e.g., South Orange County and North San Diego County) during both the morning and evening peak hours. As shown in Figure 3.2-1 the Los Angeles and Orange County metropolitan area experiences the worst congestion and travel delay (the extra time spent traveling because of congestion) in the country. According to the San Diego Association of Governments (SANDAG) all four major interstate routes in the region are faced with ever growing recurrent traffic congestion, with forecasted volumes in the year 2020 nearing 400,000 vehicles a day on Interstate 5 (I-5) and 15. Of these two freeways, I-5 is the only highway that directly connects San Diego with Los Angeles and Orange County.

Figure 3.2-1
Nationwide Highway Congestion Comparison



Although the main contributors to this congestion are local and commuter highway trips, intercity trips compete for the limited capacity on these overburdened facilities.

In Section 3.1, *Traffic and Circulation*, of this Program EIR/EIS it notes that several of the routes within the study area are currently operating at or near congested levels of operation during the peak periods. In fact, I-5 (the key intercity route assessed in this analysis) is designated by the California Department of Transportation (Caltrans) as a "high emphasis focus route" of critical importance to the movement of goods in Southern California.

3.2.3 ENVIRONMENTAL CONSEQUENCES

A. EXISTING CONDITIONS VS. NO-PROJECT ALTERNATIVE

No-Project includes programmed and funded transportation improvements to the existing transportation system that will be implemented and operational by 2020. The primary differences between existing conditions and the No-Project Alternative are the increased level of intercity travel demand and the implementation of new infrastructure. Improvements (programmed and funded) focus on existing modes; therefore, the same modes of intercity transport will continue to be available. The programmed or funded transportation improvements assumed to be in operation by 2020 are not major system-wide capacity improvements (e.g., major new highway construction or widening) and will not result in a general improvement or stabilization of existing highway conditions across the study area. Connectivity is not expected to improve with the No-Project Alternative because no new major intermodal terminals are expected to be built over the next 20 years.

As described in Section 3.1, *Traffic and Circulation*, existing facilities are currently operating at congested levels of service at numerous locations, and traffic conditions are projected to deteriorate further under the No-Project Alternative. Of the 8 intercity highway segments analyzed in Section 3.1, more than half are operating during the peak period at LOS F or a volume-to-capacity (V/C) ratio over 1.0 under existing conditions. On average V/C ratios could deteriorate by as much as 36% in some areas of the region. Capacity in the No-Project Alternative is insufficient to accommodate the projected growth in highway travel in the region. Consequently, there would be no sustainable improvement to the transportation system's capacity.

Although intercity travel is only a small percentage of all highway trips, it must compete for limited capacity on already congested infrastructure for which insufficient capacity improvement projects are planned to be operational by 2020. The region could be faced with further attempts to control demand through congestion pricing and construction of additional toll roads like SR-91 in Orange and Riverside Counties. In many instances, the a.m. peak period could extend from 2 hours to 4 hours. Likewise, as shown in Figure 3.2-2, increasing demand will lead to greater congestion, total travel time delay, and reduced reliability on the primary highway corridors in southern California.

Figure 3.2-2
Southern California Area Highway Congestion (Year 2025)

Source: Southern California Association of Governments 2001 Regional Transportation Plan

Given these travel trends, overall travel safety is also expected to worsen. As VMT continues to rise over the next 20 years under No-Project, the accident rate will not change appreciably, but the net number of accidents, injuries, and fatalities could increase, particularly for highway-based trips. As evidence of this trend, the National Highway Traffic Safety Administration reported that between 1998 and 2001 fatalities on California's roadways have increased by an average 4% annually (National Highway Traffic Safety Administration 2001).

Travel costs are also expected to rise because of the capacity constraints. The region could be faced with further attempting to control demand through congestion pricing for the auto mode. This approach could result in more congestion-priced toll roads like SR-91 in Orange and Riverside Counties.

As summarized in Table 3.2-3, the No-Project Alternative could result in either a deteriorated level of service or no change compared to existing conditions.

Table 3.2-3
Comparison of Existing Conditions to No-Project Alternative

Travel Factor	**No-Project Alternative (2020)**	
	Change from Existing Conditions	Comment
Travel Time	Deteriorate	Increased congestion could result in further delays.
Reliability	Deteriorate	Increased congestion and no change in modal options or characteristics could result in greater unreliability.
Safety	Deteriorate	No change in modal options would maintain existing fatality and injury rates; however, increased demand could result in greater number of fatalities.
Connectivity	None	No additional intercity intermodal connections or options, or increased frequencies will be available.
Sustainable Capacity	Deteriorate	No significant mainline capacity improvements will be operational.
Passenger cost	Deteriorate	Airfares are anticipated to increase beyond their current fare structures relative to other modal options.*

* Based on high-end forecasts from *Final Business Plan*, California High Speed Rail Authority 2000.
Source: Parsons Brinckerhoff 2003

B. NO-PROJECT ALTERNATIVE VS. RAIL IMPROVEMENTS ALTERNATIVE

This section presents expected travel conditions for the Rail Improvements Alternative and compares relative differences between the No-Project and the Rail Improvements Alternative. This section is organized by the six travel factors identified earlier. Each travel factor begins with a summary of the specific methods used to define and evaluate the Rail Improvements Alternative and the characteristics of the mode followed by an evaluation of the impacts of the alternatives.

Travel Time

Travel time is a key travel factor that determines the attractiveness of the mode of travel to passengers. Travel time is also an important economic factor that directly affects productivity (travel time for workers and products to get to their destination). For the purpose of this analysis, improved travel time is a benefit to the traveler because it can improve the intercity travel experience. Travel time for this analysis was measured as the total (door-to-door) travel time.

Automobile Mode Characteristics: Travel time in an automobile largely depends on three factors: distance traveled, roadway design speed (and associated speed limit), and congestion levels. The design of a roadway dictates the time that will be required to travel between two destinations. The time of day and associated congestion also plays a role in how long a trip will take. For this analysis it is assumed that the top speed of the automobile is 70 mph (113 kph).

Automobile travel times are based on driving times between the representative city pair origins and destinations, as summarized in Table 3.2-4. The travel time for highways is the same as the times used in the California High Speed Rail Authority's Final Business Plan and is based on weighted averages of peak and off-peak travel times.

Intercity Rail Mode Characteristics: With a maximum operating speed of 79-90 mph, Intercity Passenger Rail service provides a convenient way to travel between metropolitan areas (for example, between San Diego and Los Angeles via Amtrak's Pacific Surfliner service), and is an alternative to the automobile.

Intercity Rail travel in the United States has enjoyed a resurgence in ridership on many routes. While transcontinental service has seen reductions in riders, regional services such as the Pacific Surfliner, Capitol, and San Joaquin in California, Cascades in Oregon and Washington, and the Regional in the Northeast serve very active markets and are seeing increased ridership. The Pacific Surfliner service in Southern California is Amtrak's second-busiest (behind the Regional Northeastern service), carrying more than 2.1 million passengers during its 2003 Fiscal Year.

Table 3.2-4
Total Point-to-Point Travel Times (Hours:Minutes)

	Baseline Condition		No-Project Alternative		Rail Improvements Alternative	
	Auto	Rail	Auto	Rail	Low	High
Union Station to San Diego	2:35	2:44	3:15	2:36	1:58	1:48

Alternatives Comparison for Travel Time

No-Project Alternative: There are minimal travel-time benefits associated with the No-Project because the programmed improvements for 2020 do little to improve the capacity of the highway or rail system. The No-Project results in longer travel times for the highway mode compared to existing conditions, increasing by 40 minutes. Travel time for intercity rail service decreases slightly as a result of the projects incorporated into the No-Project Alternative. However, this small improvement in travel time could easily be eliminated due to potential delays caused by the remaining segments of single-track along the corridor.

Rail Improvements Alternative: Travel time savings of the Rail Improvement Alternative would vary depending on the number and location of the improvements implemented. The greatest times savings would be achieved using express service between

Los Angeles and San Diego. Because of its faster line haul speed, an improved intercity passenger rail system would compete more with the automobile for intercity trips, even when door to door times are taken into account.

Reliability

In its simplest form, reliability can be defined as variation in travel time, hour-to-hour and day-to-day for the same trip. Reliability is important for almost any travel need and on any travel mode. Business travelers want to be able to predict how long it will take them to arrive at a meeting, either across town or across the region. Express shippers need to know where packages are at all times and when they will be available for delivery. Vacationers who want to spend as little of their time off as possible traveling to and from their destinations often find themselves making their trips during the most congested days of the year. Reliable travel means fewer late arrivals, improved efficiency, saved time, and reduced frustration.

Travel on most transportation modes is consistent and repetitive, yet at the same time highly variable and unpredictable. This apparent contradiction accrues because travel is consistent and repetitive since peak usage periods occur regularly and can be predicted. The relative size and timing of rush hour is well known in most communities. Simultaneously, travel is variable and unpredictable because on any given day unusual circumstances such as a rainstorm or an auto accident can cause serious delays at any time.

The traveling public's experience with variations in travel reliability affects their decisions of how and when to travel, so that they have a reasonable expectation that they will arrive at their destination at a particular time. For example, if a highway is known to have highly variable traffic conditions, a traveler using that route routinely leaves extra time to reach their destination or may also seek an alternate route.

Travel time reliability is the direct result of the variable and often unpredictable events that can occur on different travel modes and at any time of day. The traditional way of measuring and reporting travel times experienced by highway users is to consider only average or typical conditions. However, the travel times experienced by users are seldom constant, even for travel on the same facility in the same peak or off-peak time period. Reliability is influenced by several underlying factors that vary over time and that influence the environment within which transportation operates. These factors are listed below.

- Incidents: Incidents are events that disrupt normal travel flow, such as obstructions in the travel lanes of highways. Events such as vehicular crashes, mechanical breakdowns, and debris in travel lanes are the most common form of incidents for any mode. On highways, events that occur on the shoulder or roadside can also influence traffic flow by distracting drivers, leading to changes in driver behavior and ultimately to the quality of traffic flow.

- Inclement Weather: Inclement weather and related environmental conditions (rain, fog, snow, ice, sun glare, etc.) can lead to changes in operator behavior, vehicle performance, and operational control requirements that affect traffic flow. Motorists respond to inclement weather by reducing their speeds and increasing their headways. In cases of severe weather, authorities respond by closing roadways and creating vehicle caravans.

- Construction: Construction can often reduce the number, width, or availability of travel lanes and rail tracks. Nearby construction activities can also reduce reliability if operating rules or conditions are changed (e.g., slow orders on rail tracks). Delays caused by work zones have been cited by highway travelers as one of the most frustrating conditions they encounter on trips.

- Volume Variation: Volume variation is day-to-day variability in demand that leads to some days with higher travel volumes than others. Different demand volumes superimposed on a system with fixed capacity results in variable, less reliable travel times.

Special Events: Special events such as concerts, fairs, and sports events cause localized congestion and disruption in the vicinity of the event that is radically different from typical travel patterns in the area.

- Traffic Control Devices and Procedures: These can lead to intermittent disruption of travel flow through means such as, railroad signals and switches, railroad grade crossings, drawbridges, and poorly timed signals.

- Base Capacity: Base capacity refers to the physical capacity of a transportation system, such as the number the highway lanes or runways. The interaction of base capacity with the other influences on reliability has an effect on transportation system performance. This is due to the nonlinear relationship between volume and capacity on any mode. When congested conditions are approached, small changes in volume lead to diminished throughput of the transportation system and consequent large changes in delay. Further, facilities with greater base capacity are less vulnerable to disruptions; for example, an incident that blocks a single lane has a greater impact on a highway with two travel lanes than a highway with three travel lanes.

- Vehicle Availability and Routing: These can directly affect a traveler’s ability to make an on-time trip, particularly on a common carrier such as a train, or by rental car. End-to-end routing and other strategies to maximize vehicle operation time can affect reliability when a vehicle that is needed in one location first has to complete a trip from a different location. Short layovers or “pads” that are scheduled between trips for a given vehicle also affect vehicle availability.

The extent to which these eight factors affect each of the major intercity travel modes and, by extension, the Rail Improvements Alternative is analyzed and compared on a qualitative basis by describing and ranking the extent to which each mode is potentially susceptible to each of the eight factors and is presented in Table 3.2-5 and further detailed below. Because the alternatives are composed of combinations of elements (including different modes for trip segments like station or terminal access), rankings have been combined, providing a qualitative understanding of the reliability of each alternative.

Table 3.2-5
Modal Reliability

Factor	Relative Susceptibility to Reliability Factors*	
	Automobile	**Improved Intercity Rail**
Incidents	**High** Automobile travel can be influenced by minor and major incidents at any location along the roadway and is frequently affected by incidents outside of the right-of-way.	**Low** Rail has very few major incidents and is generally not influenced by incidents on other modes since the number of grade crossings is minimal in the high-build alternative.
Weather	**High** A variety of weather conditions can degrade operator ability, make roadways impassible, or damage roadways.	**Low** Trains can operate under virtually any conditions. Track is constructed to minimize weather impact.
Construction	**Moderate** Construction activities (major and minor) are common, but generally occur during warm weather months. Lane closures are often of long-term duration.	**Low** Most activities are scheduled for hours when passenger trains are not operating. High-quality construction minimizes routine maintenance needs.
Special events	**Moderate** Special events are common and can create volume fluctuations or short-term lane closures.	**Low** Most special events can be easily accommodated on trains without effect on travel time.
Traffic control devices or procedures	**Moderate** Auto travel influenced by traffic signals, railroad crossings, and other devices. Influence depends on level to which devices are optimized.	**Moderate** Trains operate in largely, grade-separated right-of-way, minimizing external influences. Passenger trains share tracks with freight trains. Double-track minimizes switching needs.
Inadequate base capacity	**High** This is one of the strongest influences on highway reliability, particularly for facilities with three or fewer lanes per direction. Travel time degrades quickly as capacity is approached.	**Low** Operations are not allowed to exceed design capacity.
Volume variation	**High** Peak-period travel in medium to large urban areas highly influenced by day-to-day or seasonal volume variations. Strong interaction with inadequate base capacity.	**Low** Day-to-day variation in train volumes tends to be low. Passenger volume variation generally does not influence travel times.
Vehicle availability or routing	**Low** Private automobiles are ubiquitous and are widely available for rental in emergency situations. The road and highway network provides alternative routes for most trips.	**Moderate** Vehicles complete multiple end-to-end trips in a day, potentially affecting availability at specific times and locations; simple routing schemes generally followed.

Automobile Mode Characteristics: On a day-by-day basis, automobiles tend to be the least reliable of the two modes. Highway travel is highly or moderately susceptible to seven of the eight factors described above. It is only when considering the influence of vehicle availability and routing that automobiles would potentially have a lower susceptibility than would other modes.

Recent research provides further evidence on the unreliability of highway travel (Texas Transportation Institute and Cambridge Systematics, Inc. 2003). This research, which used actual travel time data covering 579 miles of freeways in the Los Angeles area, shows that reliability problems exist on highways at all times of the day, all days of the week, and all weeks of the year. This research expressed unreliability in terms of a buffer index, the amount of extra time motorists would need to budget to be certain of arriving on time at their destination 95% of the time. Results showed that a motorist in Los Angeles would need to allow an additional 45 minutes for a typical 1-hour highway trip—fully 75% of normal driving time. Even in mid-day periods, a traveler would need to budget an additional 30 minutes for the same 1-hour trip, or 50% of the normal time. It is important to note that a buffer does not represent certainty and on any given day this buffer may or may not be needed.

Intercity Rail Mode Characteristics: An improved intercity rail system has been shown to have a low susceptibility to nearly all of the major factors that affect reliability. It is only on the issues of vehicle availability that rail, like all common carrier modes, has a higher level of susceptibility than highways.

Also, an improved intercity rail system has the same or lower level of susceptibility on all eight factors compared with the existing conventional rail system. The need to share space with freight and passenger trains, coupled with extensive sections of single-track on the existing rail corridor, often lead to delays, since the delay of a single train often has the consequence of affecting other trains operating within the corridor. Double track, as an example, eliminates the delays currently associated with trains waiting at a passing track for others to clear a single tracked-section. Elimination of this type of delay alone would provide for more consistent operating schedule for trains, significantly increasing on-time performance and reliability. Proposed grade separations would also reduce the impacts of inclement weather (such as the coastal fog experienced during much of the year. These grade-separations would increase not only the reliability and operating performance of trains, but also provide for increased traffic flow on local streets that are presently subject to delays when trains are crossing.

Alternatives Comparison for Reliability

A qualitative comparison of the alternatives was conducted by considering the relative reliability of the modes that are present in each alternative, the relative modal usage in each alternative, and any major changes such as highway lane additions or modal diversion that are present in an alternative. As described more fully below, an improved intercity rail system (Rail Improvements Alternative) is projected to have the highest reliability, while No-Project is projected to have the lowest reliability.

No-Project Alternative: Reliability under No-Project is likely to be lower than under the other alternatives for the following reasons.

- No-Project depends heavily on the automobile, which has been shown to have the worst reliability of the two modes.
- Existing congestion and reliability problems continue because No-Project provides no new highway base capacity
- Greater highway congestion and more reliability problems accrue because No-Project absorbs an increasing demand for travel with little increase in base capacity.

Rail Improvements Alternative: The Rail Improvements Alternative is likely to provide the greatest degree of travel reliability for the following reasons.

- An improved intercity rail system would divert some intercity demand from less reliable highways.
- An improved intercity rail system provides a greatly improved transportation system that would have less susceptibility to many factors influencing reliability.

The various rail alignment options are not likely to exhibit appreciable differences in system reliability since system capacity and demand would be roughly equivalent. Major design differences (e.g. extent of tunneling) would not make a meaningful difference in reliability, and differences in base travel times on trains would not influence reliability.

Sensitivity to Travel Demand Forecasts: As with travel time, reliability is also influenced by the level of travel demand. Other things being equal, reliability is expected to be better on facilities that have lower travel demand (or experience lower volume-to-capacity ratios) due to the non-linear relationship between volume and capacity, as mentioned above. Therefore, lower levels of highway or air travel demand, would be expected to improve reliability for all modes. The reliability improvement would likely be greatest for No-Project since its base capacity is most constrained and would experience the largest relative improvement in volume-to-capacity ratios and delay. For the same reasons, the Rail Improvements Alternative would likely also experience a large improvement in reliability. Given the large reliability advantage enjoyed by an improved intercity rail system, the Rail Improvements Alternative would still be expected to provide the greatest degree of travel reliability across the range of travel demand scenarios.

Safety

In transportation, four basic characteristics interact to influence the safety of a mode.

- The Operator – His or her training, regulation, and experience.
- The Vehicle – Its condition, regulation, control systems, and crashworthiness.
- The Environment – The weather, guideway type, guideway condition, and terrain.
- National Security Level – Since September 11, 2001 the security threat level indicator which was adopted related to the threat level imposed by terrorists serves to greatly influence overall rail safety.

Each of these characteristics plays a role in the overall safety of the modes, which for this analysis is quantified as the probability of passenger fatality. Injuries are more difficult to compare between modes because they are categorized differently by mode and different injury ratings are used. For instance, automobile injuries are generally related to automobile crashes, while for rail they can include injuries that occur as part of a crash, while boarding/alighting, or in the terminal. The severity of these injuries can vary from scrapes and bruises to life-threatening ones. For the purposes of this analysis, injuries by mode will be discussed but are not measured as a key indicator of safety. This analysis also only considers injuries and fatalities of passengers and does not include employees or other staff.

Automobile Mode Characteristics: The automobile is unquestionably the most used and the most dangerous mode of transportation being considered in this Program EIR/EIS. The National Highway Traffic Safety Administration estimates that the national motor vehicle fatality rate is 0.80 fatalities per 100 million passenger miles traveled. Nationally in 2000, there were about 6.4 million reported motor vehicle crashes that resulted in 42,000 fatalities and 3.2 million injuries. About 4.2 million crashes involved property damage only (National Highway Traffic Safety Administration 2001). The National Highway Traffic Safety Administration estimates that deaths and injuries resulting from motor vehicle crashes are the leading cause of death for persons between the ages of 4 and 33, while traffic-related fatalities account for over 90% of all transportation-related fatalities. According to the California Highway Patrol, in 2000, there were 3,331 fatal crashes in California alone (California Highway Patrol 2000). The risk to an individual depends most strongly on the time spent behind the wheel or in the passenger's seat. The longer the journey or the more frequently the journey is made, the greater the risk of a crash. Some of the factors that influence auto and highway safety are listed below.

- Operator
  - Drivers vary in age, experience, ability, and numerous other factors.
  - Non-professional drivers typically operate automobiles.
  - Limited regulatory requirements govern who can operate an automobile and the type of training that is needed, and these requirements vary between states.
- Vehicle
  - Privately owned vehicles are mechanically not as reliable as the public transportation modes.
  - Maintenance and inspections are not regulated, and are performed by mechanics of varying skill levels.
  - Crashworthiness and roadworthiness varies depending on make and model.
  - Minimum requirements rather than optimum standards dictate safe operating conditions.
- Environment
  - Highways provide no latitudinal or longitudinal control to individual automobiles.
  - Fixed objects (e.g. trees, light poles, sign posts, etc.) are frequently placed within the highway right-of-way.
  - Weather and lighting conditions (wind, rain, fog, snow, ice, darkness, and sun glare) can adversely impact vehicle and driver performance.
  - Traffic control systems that regulate the speed and safe operation of an automobile are limited in influence.
  - Roadway conditions and designs are varied and can include systems based on different design speeds, vehicles, and operating conditions.
  - Drivers are subject to a multitude of potential distractions and interferences.

- Security
  - Traffic and passengers are dispersed presentation a low system risk
  - Highways are very difficult to secure and operators and passengers can not be screened.

Intercity Rail Mode Characteristics: Statistics show that when compared with the automobile, rail travel is by far the safest mode. In 1999 there were a total of 110 railroad fatalities in the State of California, this can be compared to 3,539 automobile fatalities within the same year. Since its formation in 1971, Amtrak has had only 100 fatalities nationwide, while moving more than 600 million passengers. For the purposes of this analysis the likelihood of injury is associated with boarding and alighting, and during operation, with injuries ranging from minor to severe. The distinguishing reasons for the safety of rail travel relative to highway travel are summarized below.

- Operator
  - Operators would be rigorously trained and tested and are required to update their qualifications regularly.
  - Operators would be required to submit to drug tests and are subject to regulation by the FRA and operating railroads.
- Vehicle
  - FRA passenger equipment safety standards (49 C.F.R. Part 238) dictate the buff strength or amount of force a train can withstand in a collision, for all passenger equipment. The buff strength is adjusted to the operating and rail traffic conditions and is designed to minimize injuries of fatalities due to rail crashes.
  - The infrastructure they operate on (tracks and control systems) would be maintained on a regular schedule. Maintenance records are subject to inspection by the FRA.
  - Passenger train equipment is built for a long service life. If maintained properly, a modern train car can have a useful life of at least 30 years.
  - Traffic control and communications systems would be state-of-the-art, regulated and managed during all hours of operation. These systems control the train's schedule, routing, and headway (following distance behind another train). These systems combined with the operator have integral redundancy and ensure safety.
- Environment
  - The improved rail system would include numerous additional grade separations, reducing pedestrian and motor vehicle conflicts.
  - Inclement weather has only a minimal impact on operations. Modern locomotives can use a cab signaling system that transmits commands directly to the driver. This technology makes higher-speed operation possible in darkness, rain, and fog.

- Although the system does operate in a highly seismic area, no injuries or fatalities have ever occurred as a result of a seismic event.
- The rail system, like other public intercity modes, is inspected on a regular schedule as required in federal regulations. This regular inspection of both rolling stock and track would ensure the safety of the system.

- Security
  - Rail systems are moderately difficult to secure and passenger trains carry many people presenting a moderate system risk.
  - Passengers can be subject to limited forms of screening to reduce security risks.

The safety characteristics of each mode are summarized in Table 3.2-6. This table shows that for all four safety characteristics, the rail mode has the best safety performance. The automobile mode fares poorest in terms of safety.

Table 3.2-6
Safety Performance by Mode

Mode	Safety Performance Characteristics			
	Operator Training Regulation Experience	**Vehicle** Condition Regulation Control Systems Crashworthiness	**Environment** Weather Guideway Condition Terrain	Security **System Risk** **Screening** **Capacity**
Automobile	Poor	Good	Poor	Good
Intercity Rail	Excellent	Excellent	Excellent	Good

Alternatives Comparison for Safety

The safety performance for each alternative is shown in Table 3.2-7. The rigorous requirements of rail operators, regular vehicle inspection, maintenance, control systems, crashworthiness, and ability to operate in virtually all weather conditions, makes the Rail Improvements Alternative superior to No-Project.

Table3.2-7
Safety Performance by Alternatives

Mode	Safety Performance Characteristics			
	Operator Training Regulation Experience	**Vehicle** Condition Regulation Control systems Crashworthiness	**Environment** Weather Guideway condition Terrain	Security **System Risk** **Screening** **Capacity**
No-Project	Poor	Good	Poor	Good
Rail Improvement Alternative	Excellent	Excellent	Excellent	Good

No-Project Alternative: While the rate of injury or fatality is not expected to increase under No-Project, the increase in highway travel would be expected to cause the number of injuries and fatalities to increase as compared to existing conditions.

Rail Improvement Alternatives: The Rail Improvements Alternative provides a superior safety benefit compared to the No-Project Alternative. The safety improvements included in the alternative will help in improving rail passenger safety within the LOSSAN corridor.

Connectivity

Connectivity in the study area can be measured qualitatively and quantitatively using the number of modal options that offer competitive transportation services, the availability of intermodal connections, and the frequency of service (number of departures). A greater number of competitive modal options is considered a benefit because it increases the diversity, redundancy, and flexibility of the overall transportation system and provides travelers with greater choices.

- Modal options are a measure of the intercity modal diversity of each alternative.
- An intermodal connection or facility allows passengers to transfer from one mode to another to complete a trip. A connection can be as simple as a timed connection between a train and a bus or as elaborate as the connections present at the Los Angeles Union Passenger Terminal (LA Union Station) where heavy rail, light rail, subway, local and long-distance buses all converge to give multiple transportation options.
- Frequency is measured as the number of departures available to travelers in the study area. High service frequency benefits travelers because it increases the number of possible connections to different modes and the number of options available for travel to a destination.

Modal Options: The No-Project Alternative provides three modal options: automobile, bus and existing intercity rail. However, intercity travel in Southern California is dominated by automobile. The automobile accounts for over 97% of all intercity trips in Southern California, with conventional rail carrying roughly 3% of the trips. Table 3.2-8 shows intercity trips by mode between the major metropolitan regions in the study area.

Table 3.2-8
1997 Intercity Trip Table Summary

Market	1997 Base Trip Tables	
	Auto	Intercity Rail
Los Angeles to San Diego	34,870,032	934,322

Source: Parsons Brinckerhoff 2003

The Rail Improvements Alternative would provide a vastly improved intercity and regional passenger mode that could provide opportunities for increased connectivity with other existing transit modes. The improved rail system would bring competitive travel times and frequent and reliable service to the traditional urban centers of the

Los Angeles and San Diego Metropolitan Areas. It would significantly improve the modal options available throughout Southern California.

Tables 3.2-9 shows intercity trips by mode within the study area projected for 2020. Under these assumptions intercity rail is projected to capture roughly 12% of the travel market.

Table 3.2-9
2020 Intercity Trip Table Summary

Market	Auto	Intercity Rail
Los Angeles to San Diego	42,023,218	5,770,000

Source: Parsons Brinckerhoff 2003 and Amtrak California

Intermodal Connections: The automobile can be used to go virtually anywhere in Southern California. Unlike common carrier transportation modes (bus or rail), the automobile does not require or depend upon intermodal connections to get from the trip origin to the trip destination. The automobile mode would have the same flexibility in No-Project and the Rail Improvements Alternative.

It is assumed that there would be limited new intermodal connections under the No-Project Alternative because a limited number of these improvements are currently planned and programmed.

Passenger rail stations are generally located where they can serve a wider area through public transit and can enhance intermodal connections in the region. Stations in the traditional urban cores of Los Angeles and San Diego currently connect to the heart of the established public transit networks. For example, LA Union Station is the transit hub of Los Angeles County and is the primary destination for the Metrolink Commuter rail services, the LA Metro Red Line, the Pasadena Gold Line, the Amtrak Surfliner service, and the regional bus transit services.

Frequency: The automobile, by offering unlimited potential frequency and because it can be driven at virtually any time and to virtually any destination, has the highest connectivity of any mode.

An improved rail system would enhance the service to the regional intercity transportation network that offers a variety of services with different stopping patterns (express, skip-stop, and local services) to serve intermediate, and shorter-distance intercity trips.

The improved intercity rail system would serve the existing stations along the LOSSAN corridor, adding two additional stations in Norwalk and University Towne Centre, with 16 intercity passenger trains a day forecasted for 2020, providing hourly service in each direction.

Alternatives Comparison for Connectivity

No-Project Alternative: Under No-Project, there would be no net improvement to the connectivity options in the Southern California over the existing conditions. There would no new modes introduced and no new intermodal terminals or connections.

Rail Improvements Alternative: The Rail Improvements Alternative would vastly improve the rail mode in Southern California's intercity transportation system. The improved rail system would improve intermodal connections at rail stations in urban centers. The system would add frequencies to the region's intercity travel network, allowing greater flexibility in travel time and location. Of the two alternatives, the Rail Improvement Alternative provide the highest level of connectivity in the study area.

Sustainable Capacity

Sustainable capacity is a measure of the transportation capacity of an alternative to meet not only the projected demand, but to provide a sustainable capacity over time without the need to develop additional infrastructure. Sustainable capacity is quantitatively measured by the amount of additional transportation infrastructure required to accommodate potential future demand beyond the demand forecast for this system.

Highway Mode Characteristics: The sustainable capacity of a highway facility depends largely on the availability of travel lanes and the speed that autos are able to travel. This relationship is expressed as level of service (LOS), which is defined in Section 3.1, Traffic and Circulation. While all modes are subject to capacity constraints that affect the vehicle's speed, given the small capacity of most automobiles (5 passengers), more vehicles are required to accommodate a large passenger demand. To meet a higher travel demand, automobiles have two basic options for increasing capacity.

- Vehicle size may be increased (buses): the higher the capacity of the vehicle, the more passengers can be carried at a high rate of speed and this assumes or requires a change in typical driver behavior.
- Capacity of the roadway may be increased (highway expansion): the addition of lanes allows more autos to travel safely with sufficient stopping distance.

Intercity Rail Mode Characteristics: Sustainable capacity of a rail system is determined by the attributes listed below.

- The capacity of rail-line (e.g., single track or double track).
- The capacity of the train (number of trainsets, or locomotives and coaches).
- The capacity of stations and passenger facilities, and the lengths of platforms.
- The speed at which the train can travel.
- The train control system.
- The degree that shared-use track is utilized by other services, thereby reducing available capacity of the passenger rail system.

The capacity constraints affecting the existing Los Angeles to San Diego intercity passenger system are in large part due to the extensive single-tracked segments along the corridor. The proposed improvements would alleviate this capacity constraint, allowing for a more balanced transportation system that would relieve some of the projected near and long-term demand on the regional transportation system.

Alternatives Comparison for Sustainable Capacity

No-Project Alternative: There is little to no sustainable capacity in No-Project. The future transportation infrastructure is severely constrained by the limited number of capacity improvements funded or programmed for 2020. Improvements associated with No-Project are generally to existing interchanges versus line capacity expansion or improvement projects. The highway system's sustainable capacity would require additional infrastructure to accommodate any growth in demand. Therefore, No-Project would not accommodate the theoretical demand and would require extensive highway infrastructure expansion to have sustainable capacity.

Rail Improvements Alternative: The Rail Improvements Alternative would provide a train system with sufficient infrastructure to meet the projected demand and to allow for capacity expansion beyond the design year requirements. It would provide an improved mode for the region's intercity transportation system, effectively creating a capacity release valve for the other intercity modes. The ultimate capacity of the system could exceed the forecasted 20- to 40-year demand by increasing frequency of service or adding cars to trainsets on the dual-track system. The Rail Improvements Alternative would have the highest sustainable capacity.

Passenger Cost

Passenger cost is a measure of the relative differences in travel costs between the No-Project and Rail Improvements Alternative. Passenger cost for this analysis means the total cost of the trip, including the cost of traveling to the station, the train fare, and other associated expenses. Cost is one of the key factors that can influence a passengers' choice of modes. Passenger cost is quantitatively measured by actual costs to the passenger associated with a typical door-to-door trip.

Automobile Mode Characteristics: For highway travel, it is assumed that the entire door-to-door trip is made with a private automobile and that there are no ancillary access costs. Automobile travel costs are show as the total costs per passenger and per auto. The total costs of owning and operating a vehicle include depreciation, maintenance, repairs, taxes, insurance, etc. and are shown on a per mile basis in Table 3.2-10. Perceived auto trip costs are considered to be lower than the total cost of auto trips based upon the assumption that fixed costs of auto ownership would be incurred regardless of trip mode choice.

Table 3.2-11 summarizes the costs for making a one-way trip for between Los Angeles and San Diego. Parking is not included even though this could be an additional expense. (All-day parking in downtown Los Angeles can be as high as $25.) As shown in the table, the door-to-door average perceived one-way cost per person for traveling between representative city pairs by highway range from $15 to $48 per passenger, and $25 to $81 for total cost.

Table 3.2-10
Auto Ownership and Operating Costs by Category (2003$)*

Cost Category	Percent of Cost	Cents
Financing	15	7.7
Depreciation	35	18.0
Fuel Tax	4	2.0
Fuel	9	4.6
Repairs	2	1.0
Maintenance	5	2.6
State Fees	3	1.5
Insurance	27	13.8
Total	**100**	**51.2**

[a] All costs escalated by 3% for 3 years to calculate 2003 dollars.
Source: FHWA, Our Nation's Highways, 2000

Table 3.2-11
One-Way Door-to-Door Trip Automobile Costs - (2003$)[a]

City Pair	Average Total Cost per Passenger[c]	Total Costs per Auto[d]
Los Angeles downtown to San Diego downtown	$25	$61

[a] All costs escalated by 3% for 3 years to calculate 2003 dollars.
[b] Total cost based on average cost of owning and operating a vehicle of 51 cents per mile divided by the assumed average auto occupancy rate of 2.4 persons (for intercity travel). Source: Federal Highway Administration, *Our Nation's Highways*, 2000.
[c] Full cost of driving a single-occupant auto based on average cost of owning and operating a vehicle of 51 cents per mile.
Source: Federal Highway Administration, Our Nation's Highways, 2000; Parsons Brinckerhoff 2003

Intercity Rail Mode Characteristics: The primary cost associated with intercity rail travel is the cost of the train ticket. For this analysis, the fare schedule currently used by Amtrak was used for comparison purposes (Table 3.2-12). This cost represents a standard one-way fare charged to passengers along the corridor from Los Angeles to San Diego.

Since train travel involves use of another mode at the beginning and end of the trip, an access and egress fee of about $5 or $6 ($10 to 12 total) are part of the average total costs. Intercity rail travel requires at least one mode change to access the nearest station.

Table 3.2-12
Intercity Rail One-Way Trip Passenger Costs (2003$)a

City Pairs	Average Total Cost[a]
Los Angeles downtown to San Diego downtown	$37

[a] Sample costs include fares as well as parking, taxi fares, and other costs involved with traveling to and from the train station.

For single occupant vehicles, the Rail Improvements Alternative would provide an overall passenger cost savings. On average the improved intercity rail system could save around 39% of the passenger costs associated with the No-Project Alternative. The intercity rail mode is cost-competitive with the highway mode for single occupant trips.

3.2.4 ALIGNMENT OPTION COMPARISON

Travel time and connectivity for the intercity rail system can all be affected by the alignment option. The improvements proposed for the LOSSAN corridor would provide a higher level of connectivity to Metrolink and the regional transit systems along the corridor, in addition to providing a higher level of reliability and safety. However, the decision on which alternative alignments to take through selected segments of the travel corridor would have implications as to the level of connectivity, reliability and safety provided. The segments, which provide the greatest difference in alternative alignments are:

- San Juan Capistrano
- Dana Point / San Clemente
- Del Mar
- University Towne Centre

Each alignment option developed for these segments has both benefits and impacts to the operations and travel conditions of the intercity rail service. Table 3.2-13 below outlines the differences between the major alignment alternatives by the established transportation factors.

Table 3.2-13
Alignment Option Comparisons

Alternative	Connectivity	Travel Time	Reliability	Safety	Capacity	Passenger Cost
San Juan Capistrano						
Trabuco Creek (Low-Build)	Provides a full replacement station	Slower travel time due to station	Same as High-Build	Same as High-Build	Same as High-Build	Same as High-Build
Interstate 5 (High-Build)	Reduces connectivity by reducing service to existing station	Faster travel time as it bypasses station	Same as Low-Build	Same as Low-Build	Same as Low-Build	Same as Low-Build
Dana Point / San Clemente						
Short Tunnel (Low-Build)	Same as High-Build	Slower travel time due to greater number of curves	Preserves part of old alignment with speed restrictions along beach	Preserves part of old alignment along beach with a high frequency of trespassing	Same as High-Build	Same as High-Build

Alternative	Connectivity	Travel Time	Reliability	Safety	Capacity	Passenger Cost
Long Split Tunnel (High-Build)	Same as Low-Build	Faster travel because of fewer curves	Fully grade separated on new alignment	Fully grade separated on new alignment	Same as Low-Build	Same as Low-Build
Del Mar						
Camino Del Mar Tunnel (Low-Build)	Same as High-Build	Slower travel time due to greater number of curves	Same as High-Build	Same as High-Build	Same as High-Build	Same as High-Build
Interstate 5 (High-Build)	Same as Low-Build	Faster travel because of fewer curves	Same as Low-Build	Same as Low-Build	Same as Low-Build	Same as Low-Build
University Towne Centre						
Interstate 5 (Low-Build)	No additional station provided	Faster travel time as it has no station	Same as High-Build	Same as High-Build	Same as High-Build	Same as High-Build
UTC Tunnel (High-Build)	Higher connectivity with a new intermodal station	Slower travel time due to station	Same as Low-Build	Same as Low-Build	Same as Low-Build	Same as Low-Build

3.3 AIR QUALITY

This section provides an overview of the two air basins studied for this Program EIR/EIS and describes the composition of air pollutants in and the status of these air basins. In addition, this section describes the potential impacts that may directly and indirectly affect regional air quality under the No Project and proposed Rail Improvements Alternative, using the existing and No Project conditions for comparison.

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Eight air pollutants have been identified by EPA as being of concern nationwide: carbon monoxide (CO sulfur oxides (SO_x), hydrocarbons (HC), nitrogen oxides (NO_x), ozone (O_3), particulate matter sized 10 microns or less (PM_{10}), particulate matter sized 2.5 microns or less ($PM_{2.5}$) and lead (Pb). Except for HC, all of these pollutants (NO_x in the form of NO_2 and SO_x in the form of SO_2) are collectively referred to as criteria pollutants. Pollutants that are considered *greenhouse gases* also affect air quality. Greenhouse gases include, NO_x, HC, and carbon dioxide (CO_2). The sources of these pollutants, their effects on human health and general welfare, and their final deposition in the atmosphere vary considerably.

3.3.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Federal Regulations

Air quality is regulated at the federal level under the Clean Air Act (CAA) of 1970 and the Final Conformity Rule (40 C.F.R. Parts 51 and 93). The Clean Air Act Amendments of 1990 (Public Law [P.L.] 101-549, November 15, 1990) direct the U.S. Environmental Protection Agency (EPA) to implement strong environmental policies and regulations that will ensure cleaner air quality. According to Title I, Section 101, Paragraph F of the Clean Air Act Amendments (42 U.S.C. § 7401 et seq.): "No federal agency may approve, accept or fund any transportation plan, program or project unless such plan, program or project has been found to conform to any applicable state implementation plan (SIP) in effect under this act." Title 1, Section 101, Paragraph F of the amendments, amends Section 176(c) of the CAA to define conformity as follows: conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not cause any of the following occurrences.

- Cause or contribute to any new violation of any NAAQS in any area.
- Increase the frequency or severity of any existing violation of any NAAQS in any area.
- Delay timely attainment of any NAAQS or any required interim emissions reductions or other milestones in any area. (42 U.S.C. § 7506[c][1].)

State Regulations

Air quality is regulated at the state level by the California Air Resources Board (CARB), the agency designated to prepare the SIP required by the federal CAA, under the California Clean Air Act of 1988 (Assembly Bill [AB] 2595) and other provisions of the

California Health and Safety Code (Health and Safety Code § 39000 et seq.). California's Clean Air Act (CCAA) requires all districts designated as nonattainment for any pollutant to "adopt and enforce rules and regulations to achieve and maintain the state and federal ambient air quality standards in all areas affected by emission sources under their jurisdiction."

The responsibility for controlling air pollution in California is shared by 35 local or regional air pollution control and air quality management districts, CARB, and EPA. The districts issue permits for industrial pollutant sources and adopt air quality management plans and rules. CARB establishes the state ambient air quality standards, adopts and enforces emission standards for mobile sources, adopts standards and suggested control measures for toxic air contaminants, provides technical support to the districts, oversees district compliance, approves local air quality plans, and prepares and submits the SIP to EPA. EPA establishes NAAQS, sets emission standards for certain mobile sources (airplanes and locomotives), oversees the state air programs, and reviews and approves the SIP. CARB inventories sources of air pollution in California's air basins and is required to update the inventory triennially, starting in 1998 (Health and Safety Code §§ 39607 and 30607.3). CARB also identifies air basins that are affected by transported air pollution (Health and Safety Code § 39610; 17 C.C.R. Part 70500).

National and State Ambient Air Quality Standards

As required by the Clean Air Act Amendments of 1970 (P.L. 91-064, December 31, 1970) and the Clean Air Act Amendment of 1977 (P.L. 95-95, August 7, 1977), EPA has established NAAQS for the following air pollutants: CO, O_3, NO_2, PM_{10}, SO_x, and Pb. CARB has also established standards for these pollutants. Recent legislation requires CARB to develop and adopt regulations to reduce greenhouse gases (AB 1493, 2002). The federal and state governments have both adopted health-based standards for pollutants. For some pollutants, the national and state standards are very similar; for other pollutants, the state standards are more stringent. The differences in the standards are generally due to the different health effect studies considered during the standard-setting process and how these studies were interpreted.

Table 3.3-1 lists the federal and state standards. The federal primary standards are intended to protect the public health with an adequate margin of safety. The federal secondary standards are intended to protect the nation's welfare and account for air-pollutant impacts on soil, water, visibility, vegetation, and other aspects of the general welfare. Areas that violate these standards are designated nonattainment areas. Areas that once violated the standards but now meet the standards are classified as maintenance areas. Classification of each area under the federal standards is done by EPA based on state recommendations and after an extensive review of monitored data. Classification under the state standards is done by CARB.

Table 3.3-1
State and National Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]		Federal Standards[b]		
		Concentration[c]	Method[d]	Primary[c,e]	Secondary[c,f,g]	Method[g]
O_3	1 hour	0.09 ppm (180 ug/m^3)	Ultraviolet photometry	0.12 ppm (235 ug/m^3)[h]	Same as primary standard	Ultraviolet photometry
	8 hour	N/A		0.08 ppm (157 ug/m^3)[h]		
PM_{10}	24 hour	50 ug/m^3	Gravimetric or beta attenuation	150 ug/m^3	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	20 ug/m^3		50 ug/m^3		
$PM_{2.5}$	24 hour	No separate state standard	Gravimetric or beta attenuation	65 ug/m^3	Same as primary standard	Inertial separation and gravimetric analysis
	Annual arithmetic mean	12 ug/m^3		15 ug/m^3		
CO	8 hour	9.0 ppm (10 mg/m^3)	Non-dispersive infrared photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-dispersive infrared photometry (NDIR)
	1 hour	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 hour (Lake Tahoe)	6 ppm (7 mg/m^3)		N/A		
NO_2	Annual arithmetic mean	N/A	Gas phase chemilum-incescence	0.053 ppm (100 ug/m^3)	Same as primary standard	Gas phase chemilum-incescence
	1 hour	0.25 ppm (470 ug/m^3)		N/A		
Pb[i]	30 days average	1.5 ug/m^3	Atomic absorption	N/A	N/A	High volume sampler and atomic absorption
	Calendar quarter	N/A		1.5 ug/m^3	Same as primary standard	
SO_2	Annual arithmetic mean	N/A	Ultraviolet Fluorescence	0.030 ppm (80 ug/m^3)	N/A	Spectro-photometry (Pararosoani-line method)
	24 hour	0.04 ppm (105 ug/m^3)		0.14 ppm (365 ug/m^3)	N/A	
	3 hour	N/A		N/A	0.5 ppm (1300 ug/m^3)	
	1 hour	0.25 ppm (655 ug/m^3)		N/A	N/A	

Table 3.3-1
State and National Ambient Air Quality Standards (continued)

Pollutant	Averaging Time	California Standards[a]		Federal Standards[b]		
		Concentration[c]	Method[d]	Primary[c,e]	Secondary[c,f,g]	Method[g]
Visibility reducing particles	8 hour (10 a.m. to 6 p.m., Pacific Standard Time)	In sufficient amount to produce an extinction coefficient of 0.23 per km-visibility of 10 mi (16 km) or more (0.07–30 mi [.011–48 km] or more for Lake Tahoe) due to particles when the relative humidity is less than 70%. Method: Beta attenuation and transmittance through filter tape.		No federal standards		
Sulfates	24 hour	25 ug/m^3				
Hydrogen sulfide	1 hour	0.03 ppm (42 ug/m^3)	Ultraviolet fluorescence			
Vinyl Chloride[h]	24 hour	0.01 ppm (26 ug/m^3)	Gas chroma-tography			

[a] California standards for O_3, CO (except Lake Tahoe), SO_2 (1 and 24 hour), NO_2, suspended particulate matter-$PM_{10,}$ $PM_{2.5}$, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[b] National standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For $PM_{10,}$ the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 ug/m3 is equal to or less than one. For $PM_{2.5}$, the 24 hour standard is attained when 98%of the daily concentrations, averaged over 3 years, are equal to or less than the standards.

[c] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25^o C (77 ^{o} F) and a reference pressure of 760 mm (30 in) of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25^o C (77 ^{o} F) and reference pressure measurements of air quality are to be corrected to a reference temperature of 25o C (77 ^{o} F) and a reference pressure of 760 mm (30 in) of mercury (1,013.2 milibar [1 atmosphere]); ppm in this table refers to ppm volume, or micromoles of pollutant per mole of gas.

[d] Any equivalent procedure that can be shown to the satisfaction of CARB to give equivalent results at or near the level of the air quality standard may be used.

[e] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.
National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[f] Reference method as described by EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by EPA.

[g] New federal 8-hour O_3 and $PM_{2.5}$ standards were promulgated by EPA on July 18, 1997.

[h] ARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Source: California Air Resources Board 2003

B. METHOD OF EVALUATION OF IMPACTS

Pollutants

Pollutants that can be traced principally to transportation sources and are thus relevant to the evaluation of the project alternatives include CO, O_3 precursors (NO_x and total organic gases or TOG), PM_{10}, and CO2. Since high CO levels are mostly the result of congested traffic conditions combined with adverse meteorological conditions, high CO concentrations generally occur within 300 ft (91 m) to 600 ft (183 m) of heavily traveled roadways. Concentrations of CO on a regional and localized or microscale basis can consequently be predicted appropriately. TOG and NO_x emissions from mobile sources are of concern primarily because of their role as precursors in the formation of O_3 and particulate matter. O_3 is formed through a series of reactions that occur in the atmosphere in the presence of sunlight over a period of hours. Since the reactions are slow and occur as the pollutants are diffusing downwind, elevated O_3 levels are often found many miles from sources of the precursor pollutants. The impacts of TOG and NO_x emissions are therefore generally examined on a regional level. CO2 emission burdens, because of their global impact, are currently expressed only on the statewide level by CARB and EPA. In this analysis, however, CO2 impacts are discussed on the regional level. It is appropriate to predict concentrations of PM_{10} on a regional and localized basis. EPA is currently developing a standardized methodology to evaluate PM_{10} on a local level.

Pollutant Burdens

The air quality analysis for this Program EIR/EIS focuses on the potential regional and localized impacts on air quality. The estimated regional pollutant burdens were quantified for the No Project and Rail Improvements Alternatives, based on the changes that would occur in the number of locomotives traveling along the LOSSAN corridor. Regional changes in vehicular traffic are not addressed in this analysis. Although the Rail Improvements Alternative is expected to accommodate part of the demand for increased passenger rail service, the projected population and employment increase between now and 2020 would result in increased vehicular traffic as well. Therefore, the Rail Improvements Alternative would not have a substantive effect on regional VMT.

Potential changes in localized vehicular traffic and in emissions caused by construction are addressed qualitatively in this analysis. These potential changes cannot be quantified without project-level design and construction planning information, which would not be available until a later analysis stage.

3.3.2 Affected Environment

A. STUDY AREA DEFINED

California is divided into 15 air basins (17 C.C.R. § 60100 et seq.). Each has unique terrain, meteorology, and emission sources. The two air basins directly affected by the proposed alternatives are the South Coast and San Diego air basins (see Figure 3.3-1. Air quality in nearby air basins could also be affected by the proposed alternatives. These effects are expected to be less than those experienced by the basins that physically contain the project. For this program-level analysis, potential impacts on air quality are described only for the air basins that physically contain the LOSSAN rail corridor. Nearby air basins are not discussed in this program-level analysis. Once the alternatives are refined and more detailed analyses are conducted, nearby basins should be studied.

B. GENERAL DISCUSSION OF AIR QUALITY RESOURCES

Each pollutant is briefly described below.

- Carbon monoxide (CO) is a colorless, odorless gas that is generated in the urban environment primarily by the incomplete combustion of fossil fuels in motor vehicles. Relatively high concentrations of CO can be found near crowded intersections and along heavily used roadways carrying slow-moving traffic. CO chemically combines with the hemoglobin in red blood cells to decrease the oxygen-carrying capacity of the blood. Prolonged exposure can cause headaches, drowsiness, or loss of equilibrium.

- Sulfur oxides (SO_x) constitute a class of compounds of which sulfur dioxide (SO_2) and sulfur trioxide (SO_3) are of great importance in air quality. SO_x is also generated by the incomplete combustion of fossil fuels in motor vehicles. However, relatively little SO_x is emitted from motor vehicles. The health effects of SO_x include respiratory illness, damage to the respiratory tract, and bronchio-constriction.

- Hydrocarbons (HC) comprise a wide variety of organic compounds, including methane (CH4), emitted principally from the storage, handling, and combustion of fossil fuels. Hydrocarbons are classified according to their level of photochemical reactivity: relatively reactive or relatively non-reactive. Non-reactive hydrocarbons consist mostly of methane. Emissions of total organic gases (TOG) and reactive organic gases (ROG) are two classes of hydrocarbons measured for California's emission inventory. TOG includes all hydrocarbons, both reactive and non-reactive. In contrast, ROG includes only the reactive HC. TOG is measured because non-reactive HC have enough reactivity to play an important role in photochemistry. Though HC can cause eye irritation and breathing difficulty, their principal health effects are related to their role in the formation of ozone. HC is also considered a greenhouse gas.

- Nitrogen oxides (NO_x) constitute a class of compounds that include nitrogen dioxide (NO_2) and nitric oxide (NO), both of which are emitted by motor vehicles. Although NO_2 and NO can irritate the eyes and nose and impair the respiratory system, NO_x, like HC, is of concern primarily because of its role in the formation of ozone. Nitrogen oxide is also considered a greenhouse gas.

- Ozone (O_3) is a photochemical oxidant that is a major cause of lung and eye irritation in urban environments. It is formed through a series of reactions involving HC and NO_x that take place in the atmosphere in the presence of sunlight. Relatively high concentrations of O_3 are normally found only in the summer because low wind speeds or stagnant air coupled with warm temperatures and cloudless skies provide the optimum conditions for O3 formation. Because of the long reaction time involved, peak ozone concentrations often occur far downwind of the precursor emissions. Thus, ozone is considered a regional pollutant rather than a localized pollutant.

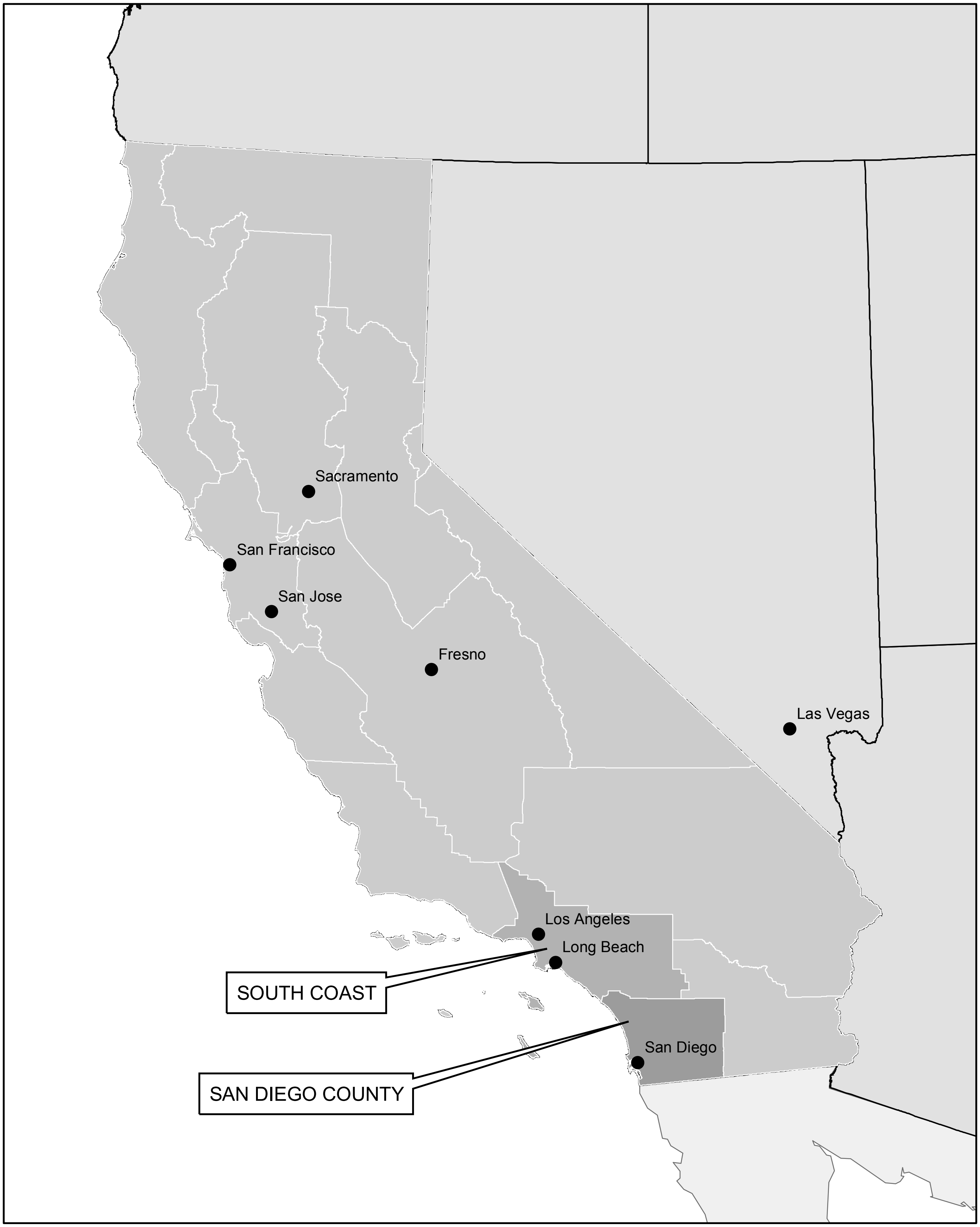


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FIGURE 3.3-1

Air Basins Potentially Affected by Project Altenatives

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- Particulate matter includes both airborne and deposited particles of a wide range of size and composition. Of particular concern for air quality are particles smaller than or equal to 10 microns and 2.5 microns in size, PM_{10} and $PM_{2.5}$, respectively. The data collected through many nationwide studies indicate that most PM_{10} is the product of fugitive dust, wind erosion, and agricultural and forestry sources, while a small portion is produced by fuel combustion processes. However, combustion of fossil fuels account for a significant portion of $PM_{2.5}$. Airborne particulate matter mainly affects the respiratory system.

- Lead (Pb) is a stable chemical element that persists and accumulates both in the environment and in humans and animals. There are many sources of lead pollution, including mobile sources such as motor vehicles and other gasoline-powered engines, and non-mobile sources such as petroleum refineries. Lead levels in the urban environment from mobile sources have significantly decreased due to the federally mandated switch to lead-free gasoline. The principal effects of lead on humans are on the blood-forming, nervous, and renal systems.

- Carbon dioxide (CO2) is a colorless, odorless gas that occurs naturally in the earth's atmosphere. Significant quantities are also emitted into the air by fossil fuel combustion. CO2 is considered a greenhouse gas. The natural greenhouse effect allows the earth to remain warm and sustain life. Greenhouse gases trap the sun's heat in the atmosphere and help determine our climate. As atmospheric concentrations of greenhouse gases rise, so may temperatures. Higher temperatures may result in more emissions, increased smog, and respiratory disease.

The existing (year 2001) baseline pollutant burden for each of the air basins is described in the following section. The existing baseline represents the current air quality conditions in each of the air basins in the study area.

C. AIR RESOURCES BY AIR BASIN

The air quality attainment status based on state and federal standards for CO, particulate matter, and O_3 for each of the air basins in the study area is shown in Table 3.3-2. All air basins are assigned an attainment status for air pollutants based on meeting state and federal pollutant standards. There are some differences between state and federal standards, so a pollutant might not have the same status under each standard. A basin is considered in attainment for a particular pollutant if it meets the standards set for that pollutant. A basin is considered in maintenance for a pollutant if the standards were once violated but are now met. And a basin is considered nonattainment for a particular pollutant if its air quality exceeds standards for that pollutant. A basin is considered unclassified if the area cannot be classified on the basis of available information as meeting or not meeting the applicable standard. The standards and status designations are discussed in more detail above in Section 3.3.1, Regulatory Requirements and Methods of Evaluation.

Table 3.3-2
Attainment Status of Affected Air Basins

Air Basin	Pollutant					
	CO		PM_{10}		O_3	
	National Standard	State Standard	National Standard	State Standard	National Standard	State Standard
South Coast	Nonattainment	Non-attainment/ transitional	Nonattainment	Nonattainment	Nonattainment	Nonattainment
San Diego County	Maintenance	Attainment	Unclassified	Nonattainment	Nonattainment	Nonattainment

Source: California Air Resources Board 2002

South Coast Air Basin

The South Coast Air Basin encompasses 6,729 sq mi (17,428 sq km). It includes California's largest metropolitan region: all of Orange County, the western highly urbanized portions of San Bernardino and Riverside Counties, and the southern two-thirds of Los Angeles County. It accommodates a population of 14.9 million, or more than 40% of California's population, and is the most populous air basin in the state. About 30% of the state's total criteria pollutant emissions are generated in the basin. The basin is generally a lowland plain bounded by the Pacific Ocean on the west and by mountains on the other three sides.

The population in the South Coast Air Basin grew at high rates from 1981 to 2000, increasing 34% from 11.1 million in 1981 to 14.9 in 2000. Daily VMT increased about 84% during that same period. While high growth rates are generally associated with increased emissions, the implemented control programs in the basin have resulted in emission decreases.

The warm weather associated with predominantly high-pressure systems in the basin is conducive to the formation of O_3. The surrounding mountains help cause frequent low inversion heights and stagnant air conditions. These factors combine to trap pollutants in the air basin, and resulting concentrations are among the highest in the state. Aggressive emission controls have resulted in a downward trend in O_3 levels. The basin is classified as both a state and national nonattainment area for O_3 (1-hour standard).

NO_x emissions in the basin fell by about 38% from 1985 to 2000 and are forecasted to continue that trend to 2010. ROG emissions remained relatively flat from 1975 to 1985. Between 1985 and 2000 they decreased by approximately 60%. ROG emissions are predicted to decrease another 40% by 2010.

Emissions of CO in the South Coast Air Basin have been trending downward since 1975, even though VMT has increased and industry activity has grown. Los Angeles County is designated as nonattainment for the state ambient air quality standards, while the remainder of the air basin is designated as attainment. The basin is designated as nonattainment for CO for the national ambient air quality standards.

Direct emissions of PM_{10} have increased in the South Coast Air Basin since 1975. The increase is attributed to emissions from area-wide sources such as fugitive dust from paved and unpaved roads. Growth in activity of the area-wide sources reflects the increased population growth and VMT in the basin. PM_{10} continues to be a problem in the South Coast Air Basin, which is designated as nonattainment for both the state and national ambient air quality standards. More controls specific to PM_{10} will be needed to reach attainment.

San Diego Air Basin

The San Diego Air Basin is located in the southwestern corner of California and comprises all of San Diego County. It is bounded on the south by Mexico, on the west by the Pacific Ocean, on the north by Orange and Riverside Counties, and on the east by Imperial County. Its 4,260 sq mi (11,033-sq km) area accommodates a population of 2.9 million or 8% of the state's population and produces about 7% of the state's criteria pollutant emissions.

In the last 20 years, the San Diego Air Basin has experienced one of the highest population growth rates of the state's urban areas. Population grew from over 1.9 million in 1981 to 2.9 million in 2000. VMT more than doubled during that same period from 35 million to approximately 74 million mi (56 million to 119 million km). Despite this growth trend, the overall air quality of the basin has improved, reflecting the benefits of cleaner technology.

Much of the San Diego Air Basin has a relatively mild climate due to its southern location and proximity to the ocean. The majority of the population is concentrated in the western portion of the basin, and the emissions are concentrated there. The basin is impacted by locally produced emissions as well as pollutants transported from other areas. O_3 and O_3 precursor emissions are transported from the South Coast Air Basin and Mexico. Implemented controls have resulted in a downward trend in O_3 levels and reductions in emissions from its precursors NO_x and ROG in the basin. However, O_3 levels continue to pose problems because exceedances of the state and national ambient air quality standards persist.

CO concentrations in the San Diego Air Basin decreased approximately 56% from 1981 to 2000. As a result, the national CO standards have not been exceeded since 1989, and the state standard has not been exceeded since 1990. The basin will likely maintain its attainment status for both national and state standards by continuing the enforcement of the stringent motor vehicle regulations currently in place.

Direct emissions of PM_{10} in the San Diego Air Basin increased 69% from 1975 to 2000, and the forecast is for a continued increase at a rate of approximately 7% to 2010. Growth in area-wide source emissions, mainly fugitive dust from vehicles on paved and unpaved roads, dust from construction and demolition operations, and particulates from residential fuel combustion are mainly responsible for this increase. The growth in these area-wide sources primarily derives from the increase in population and VMT in the basin. The San Diego Air Basin is designated as nonattainment for the state ambient air quality standard and is unclassified for the national standard.

3.3.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

As described in Chapter 1, Purpose and Need, the volume of train traffic on the LOSSAN corridor is projected to nearly double by the year 2020. (Refer to

Section 1.2.2-A, Travel Demand, for numbers of existing and projected trains in the corridor.) The number of locomotive miles (kilometers) traveled in the corridor will increase an estimated 85% by 2020, with passenger rail miles increasing 69% and freight rail miles increasing 95% above 2003 levels.

This change from existing to future No-Project conditions will increase the air pollutant emissions from locomotives in the project region. The estimated emissions and percent change between 2003 and 2020 are shown in Table 3.3-3. An approximate division of those emissions between the South Coast and the San Diego air basins is shown in Table 3.3-4. Appendix 3.3-A provides more detail on the assumptions and emission factors used for these estimates.

Table 3.3-3
Estimated Locomotive Emissions in the LOSSAN Rail Corridor
Year 2003 and 2020

Pollutant	Total Emissions 2003[1] tons/year	Total Emissions 2020[1] tons/year	Difference tons/year	Percent Change 2003-2020
TOG	88.47	123.17	34.70	39%
CO	235.33	443.77	208.44	89%
NO_x	2,014.00	2,283.94	269.95	13%
PM	59.27	80.54	21.27	36%
CO_2	89,486	168,749	79,263	89%

[1] Combined passenger and freight rail. Each freight train is assumed to have 4 locomotives.

Table 3.3-4
Estimated Total Locomotive Emissions in the LOSSAN Corridor by Air Basin
Year 2003 and 2020

Pollutant	Total Emissions 2003 tons/year	Total Emissions 2020 tons/year	Change from 2003 to 2020 tons/year	Percent Change 2003-2020
South Coast Air Basin				
TOG	58.96	87.52	28.56	48%
CO	156.84	315.32	158.48	101%
NO_x	1,342.28	1,622.85	280.57	21%
PM	39.50	57.23	17.73	45%
CO_2	59,640.74	119,904.45	60,263.71	101%
San Diego Air Basin				
TOG	29.51	35.65	6.15	21%
CO	78.49	128.45	49.96	64%
NO_x	671.71	661.09	-10.62	-2%
PM	19.77	23.31	3.54	18%
CO_2	29,845.75	48,844.56	18,998.82	64%

[1] Combined passenger and freight rail. Each freight train is assumed to have 4 locomotives.

Train emissions are a very small part of the overall pollutant burden in the study area and statewide. Figure 3.3-2 shows the percentage contribution of four transportation and utility sources statewide for the year 2020. Of the four sources of concern shown in the figure, on-road mobile is the largest single contributor for all the pollutants.

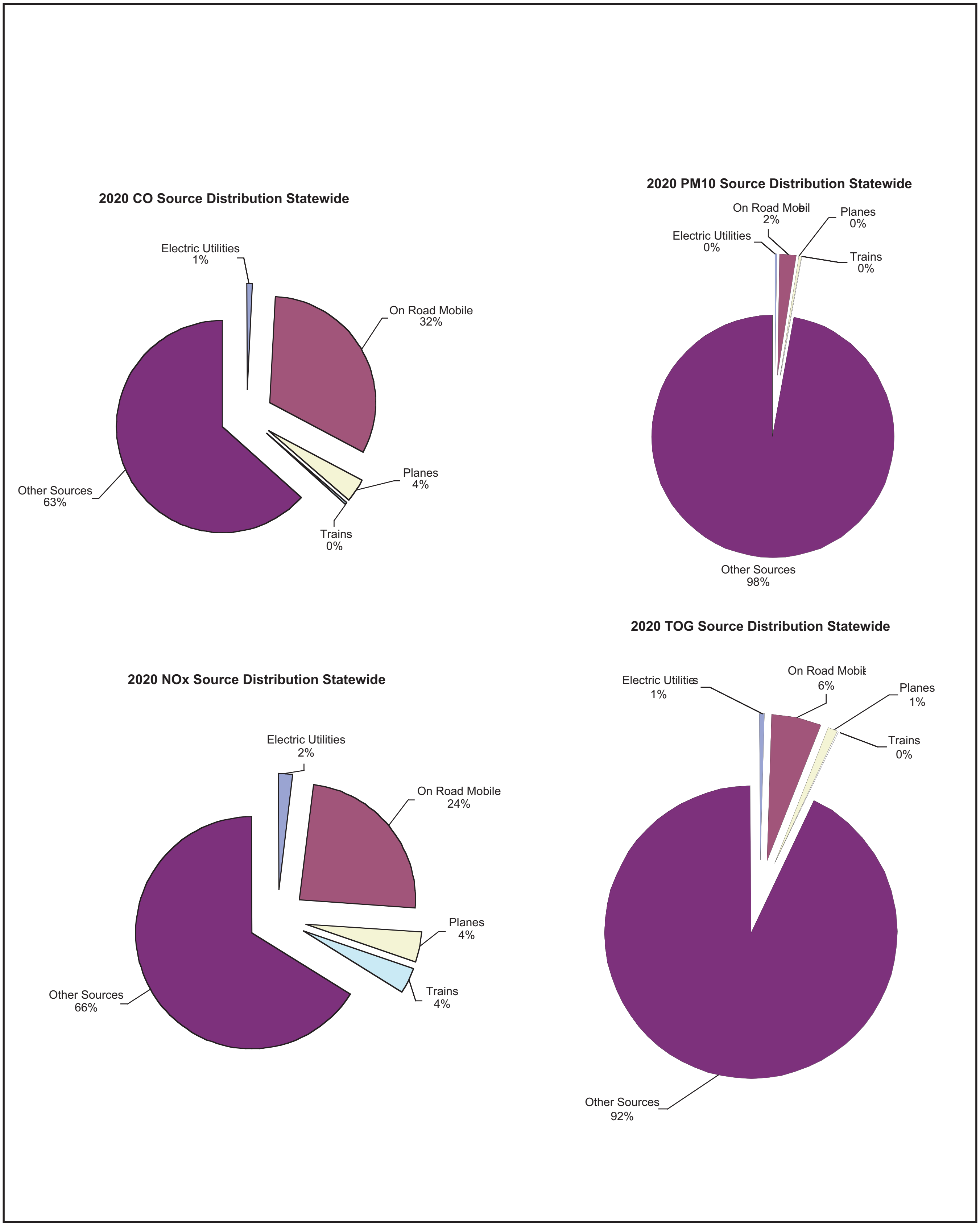

FIGURE 3.3-2

CO, PM, NOx, TOG Source Distribution - Year 2020

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The on-road vehicle travel in the LOSSAN region is expected to increase substantially by 2020. As described in Chapter 1, automobile traffic between Los Angeles and San Diego is expected in increase 18% by 2025. The increased highway travel will also add to pollutant burdens in the project region. However, emissions per vehicle are dropping significantly in California as a result of CARB's clean vehicle and clean fuel programs. Pollutant burden levels of CO, NO_x, and TOG are predicted to decrease statewide through 2020 compared to 2001 levels due to the implementation of stringent standards, control measures, and state-of-the-art emission control technologies. The low emission vehicle (LEV) and LEVII regulations adopted in 1990 and 1998, respectively, require a declining average fleet emission rate for new cars, pickup trucks, and medium-duty vehicles (including sport utility vehicles). These regulations, which are being implemented between 1994 and 2010, are expected to result in about a 90% decline in new vehicle emissions. Similar emission reductions are occurring in the heavy-duty diesel truck fleet as progressively lower emission standards for new trucks are introduced. The next phase of tighter diesel truck standards, scheduled to be implemented between 2007 and 2010, is expected to produce an overall reduction of 98% from uncontrolled engine emissions.

Emissions of PM_{10} are expected to increase in both air basins for the No Project Alternative compared to existing conditions. The upward trend in PM_{10} emissions is primarily due to increased emissions from area-wide sources, including dust from increased VMT on unpaved and paved roads. PM_{10} emissions from stationary sources are also expected to increase slightly in the future because of industrial growth.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Rail service in the LOSSAN corridor is not predicted to increase over 2020 No Project levels as a result of the Rail Improvements Alternative[1]. Therefore, no direct change in pollutant burdens from the number of locomotives in the corridor would occur with project implementation. Traffic around existing LOSSAN stations would increase somewhat over 2020 No Project levels as a result of the proposed project, because the increased efficiency and reliability of passenger rail service would attract additional riders. This could increase vehicular emissions in localized air quality hotspots around stations, as compared with the No Project Alternative. Hotspots are areas where the potential for elevated pollutant levels exist.

The projected increase in rail traffic between now and 2020 would result in higher levels of congestion and delays in train traffic without the proposed improvements to the corridor. The existing rail service is subject to delays and congestion, particularly in segments where the corridor is single tracked. These bottlenecks would increase in severity as rail service increases over the next 20 years and beyond. The Rail Improvements Alternative would decrease the likelihood of delays along the corridor, which would decrease the emissions from idling locomotives. The proposed double tracking would also decrease locomotive idling time at existing LOSSAN stations as rail service increases. At this program level of analysis, it is not possible to quantify the potential air quality benefits of decreased congestion and locomotive idle time along the corridor.

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[1] As described in Chapter 4, the predicted increase in the number of trains in the corridor by 2020 under the No Project Alternative would require that more of the freight traffic be shifted to nighttime hours, whereas the Rail Improvements Alternative would allow both passenger and freight rail operations to continue simultaneously within the corridor.

The grade separations that would occur with many of the proposed improvement options would also contribute to a reduction in potential emissions from idling automobiles and trucks at grade crossings. Reductions in emissions from reduced waiting time at crossings would be greatest in the congested urban roadways in the metropolitan areas of Los Angeles, Orange County, and San Diego. The proposed double tracking through the study area could also reduce vehicular delays at crossings by allowing two trains to pass through a given area at the same time.

If the Miramar Hill tunnel option were constructed in the rail segment between the I-5/805 split and Highway 52, a new underground station would be constructed at University Towne Centre (UTC). This station could increase local traffic congestion and create hotspots at intersections in the vicinity.

Construction of the proposed improvements would cause temporary increases in pollution burdens in the project area. Emissions sources would include diesel-powered construction equipment, work-force travel to and from the project site, and fugitive dust from construction activities. Implementation of the Rail Improvements Alternative would be done incrementally over a period of many years. Impacts to air quality would be spread out both geographically and over time in the study area, reducing the potential for high cumulative impacts in the air basins. PM emissions from fugitive dust and construction equipment would be short-term but could be potentially significant due to the nonattainment status of the South Coast and San Diego air basins, and the likelihood of continued increases in PM from development in the region.

Overall, the Rail Improvements Alternative would result in beneficial reductions in emissions by decreasing rail congestion along the corridor and at existing stations, and by reducing the number of grade crossings where vehicular traffic delays now occur. Construction of the improvements would have short-term, potentially high impacts on air quality.

3.3.4 Mitigation Strategies

At the project level potential mitigation strategies should be explored to address the potential for localized impacts of the Rail Improvements Alternative. Potential construction impacts, which should be analyzed once more detailed project plans are available, can be mitigated by following local and state guidelines.

3.3.5 Subsequent Analysis

If a decision is made to proceed with the Miramar Hill/UTC option, local traffic counts could be conducted at access roads serving the potential UTC station location. These counts would provide more accurate information for determining potential local air quality hotspot locations. Once hotspot locations (if any) are determined, a detailed analysis following the guidelines at the time of analysis should be conducted.

Potential construction impacts and potential mitigation measures should also be addressed in subsequent analyses. Once an alignment option is established a full construction analysis should be conducted. This analysis should quantify emissions from construction vehicles, excavation, worker trips, and other related construction activities. Mitigation measures, if required, should be detailed and a construction monitoring program, if required should be established.

3.4 NOISE AND VIBRATION

This section identifies the potential for noise and vibration impacts on sensitive receptors or receivers, such as people in residential areas, schools, and hospitals, for the No Project and Rail Improvements Alternatives. This analysis generally describes the sensitive noise receptors in the project region and the methodology for determining the potential for noise and vibration impacts on those receptors for each alternative and alignment option. The comparison of alignment options considers the potential for noise impacts from both passenger and freight trains on the LOSSAN rail corridor. The section also discusses the potential for benefits of adding grade separations[1] along the existing LOSSAN corridor, thereby reducing noise generated at grade crossings. Since this is a program-level environmental document, the analysis of potential noise and vibration impacts broadly compares the relative differences in the potential for impacts between the proposed alignment options.

3.4.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Noise and vibration are among the environmental issues to be evaluated under NEPA and CEQA. The FRA enforces compliance with the Noise Emission Regulation adopted by the EPA for noise emissions from interstate railroads. The FRA's Railroad Noise Emission Compliance Regulation (49 C.F.R. Part 210) prescribes minimum compliance regulations for enforcement of the railroad noise emission standards adopted by the EPA (40 C.F.R. Part 201). The FRA has also established criteria for assessment of noise and vibration impacts for high-speed[2] ground transportation projects (U.S. Department of Transportation 1998). For speeds less than 125 mph (200 kph) the Federal Transit Administration (FTA) has similar criteria for assessment of noise and vibration impacts (U.S. Department of Transportation 1995). The methodology and impact criteria for noise and vibration from the FRA and FTA guidance manuals have been used in the assessment of the Rail Improvements Alternative.

As described below, each agency's criteria were used to define a screening distance for assessing the potential for noise impact from relevant sources. The FRA and FTA have also established vibration impact criteria related to rail transportation.

At the state level, the California Noise Control Act was enacted in 1973 (Health and Safety Code § 46010 *et seq.*) and provides for the Office of Noise Control in the Department of Health Services to (1) provide assistance to local communities developing local noise control programs, and (2) work with the Office of Planning and Research to provide guidance for the preparation of the required noise elements in city and county general plans, pursuant to Government Code Section 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify to the extent practicable current and projected noise levels for various sources, including highways and freeways, passenger and freight railroad operations, ground rapid transit systems, commercial, general, and military aviation and airport operations, and other ground stationary noise sources. Noise level contours must be mapped for these sources, using both community noise equivalent level (CNEL) and day-night average

1 For this analysis, a grade separation is the separation, using overpasses or underpasses, of the rail and roadway components of an at-grade crossing. This separation reduces the need for trains to blow horns at grade crossings and eliminates the need for warning bells.
2 In this context, "high speed" is defined as rail with a maximum speed of 125 mph (200 kph) or greater.

level (L_{dn}) and are to be used as a guide in land use decisions to minimize the exposure of community residents to excessive noise.

B. METHOD OF EVALUATION OF IMPACTS

Two basic evaluation techniques were used for this analysis: a screening analysis, and more specific analysis of typical case studies of representative locations for the proposed Rail Improvements Alternative. The screening analysis provides a basis for a comparison of relative differences between existing conditions and the Rail Improvements Alternative in potential noise impacts. The case studies were used to verify screening analysis assumptions and to provide a basis for comparison of alignment options, including consideration of the potential effectiveness of mitigation and the potential impacts or benefits associated with grade separation of the existing rail line.

Screening Procedure

Transportation noise impacts are typically assessed according to the number of people and noise-sensitive land uses potentially impacted by new or changed noise sources from a project. However, for a three-county project such as the proposed Rail Improvements Alternative (especially before many project-level details have been defined) it is not possible to develop a specific measure of the potential noise impacts because information necessary for performing a detailed noise analysis is not available. Consequently, a screening method was used to develop a general estimate of the relative potential for impact among alignment options. Screening distances were applied from the center of potential alignments to estimate all potentially impacted land uses in noise sensitive environmental settings (Appendix 3.4-A). The estimated number of people and number of noise-sensitive land uses are tabulated within the defined screening distance. (See Appendix 3.4-B) The method is conservative in that it overestimates the potential impact. The method identifies all potentially impacted developed lands by type of use within the study area, but subsequent project-level analysis using better-defined system parameters and affected populations is likely to indicate lower levels of potential impact. Because potential noise impacts decrease dramatically if a structure blocks the path to the receptor, this is a conservative approach.

Noise screening analyses were performed for the Rail Improvements Alternative. Screening distances were selected for the railroad based on criteria established by the agencies that regulate these modes, the FRA and FTA (see Appendix 3.4-A).

The analyses were accomplished using available GIS data for land use and alignment geometry for each alternative. The number of people potentially affected and the area of noise-sensitive land uses within the screening distance were determined using GIS and census data.

The potential impacts were subsequently combined to develop an impact rating for each rail segment, described as low, medium, or high, as an indication of the potential for noise impact.

Application of Screening Method to Conventional Rail Mode

Railroad noise and vibration criteria developed by FTA are consistent with criteria adopted by the FRA for high-speed trains. The FRA screening procedure was developed for train speeds from 125 mph to 210 mph (200 kph to 338 kph).[3] For speeds less than 125 mph (200 kph) and for areas near stations, the FTA screening method was used in concert with the FRA method. The FRA and FTA screening distances for noise are included in Appendix 3.4-A. They were used to assess conventional rail operations in the No Project and the Rail Improvements Alternative.

Criteria for rail noise impact assessment are based on activity interference and annoyance ratings developed by EPA. These criteria, described and presented in graphical form in Appendix 3.4-C, provide the basis for the rail noise analysis procedures used in the screening and the representative typologies (U.S. Department of Transportation 1998).

The screening procedure used by the FRA and FTA takes into account the noise impact criteria, the type of corridor, and the ambient noise conditions in typical communities. Distances within which potential impacts may occur are defined based on operations of a typical high-speed train system. These distances were developed from detailed noise models based on empirical measurements of noise emissions of existing steel-wheel/steel-rail high-speed trains, expected maximum operation levels and speeds, and residential land use. The width of the potential impact along the length of the rail alignment is the area in which there is potential for noise impact.

The screening distances are different for the different types of developed areas along a potential alignment according to their estimated existing ambient noise. “Urban” and “noisy suburban” areas are grouped together. These areas are assumed to have ambient noise levels greater than 60 dBA L_{dn}. Similarly, “quiet suburban” and “rural” or “natural open-space” areas are grouped as areas where ambient noise levels are less than 55 dBA L_{dn}. For developed land with L_{dn} between 55 and 60 dBA, the classification is dependant on other factors such as proximity of major transportation facilities and density of population. The screening procedure was applied to first allow for the comparison of impacts between alignment options and to identify areas of potential impacts for further consideration in project-level analysis. The screening procedure estimates the affected receptors to ensure that all potential impacts are included at the program level.

While the screening procedure is based on the type of equipment, operational characteristics of the future rail services (speeds and frequencies), the type of support structure (aerial or at grade), and the general ambient noise level, it does not address the horn and bell noise associated with existing passenger and freight trains because these are regarded as part of the existing environment and are assumed to be held constant for both the No Project and the Rail Improvements Alternatives. To develop a relative comparison of the rail improvement alignment options, the results of the screening analysis were adjusted to account for noise reductions from the elimination of grade crossings along the existing rail line, proposed as part of some alignment options. The degree of adjustment was based on the representative typologies for similar circumstances and is defined in the following section.

As a final step for those areas rated medium or high for potential impacts, the screening analysis assessed the potential use of noise barriers and other mitigation options to

3 The maximum speed of the trains on the LOSSAN corridor with proposed rail improvements in place is expected to be 125 mph (200 kph).

assess the potential for reducing noise impacts. The mitigation analysis is discussed in Section 3.4.5.

Vibration impact screening was performed for the Rail Improvements Alternative to compare potential impacts among alignment options and to provide an estimate of the length of alignments where consideration of vibration attenuation features may be appropriate.

Representative Typologies for Trains

To better understand the potential impacts of the Rail Improvements Alternative, several noise impact assessment studies were prepared for representative situations of noise- and vibration-sensitive land uses. The more detailed General Assessment Method of FTA's and FRA's guidance manuals were used to provide noise impact estimations. The FRA and FTA noise impact criteria of *severe impact*, *impact* and *no impact* were applied to the results. These typological studies verified the general results from the screening procedure. Representative situations were chosen to provide a range of potential impact types and levels. This approach provides a means of considering at the program level the potential impacts on communities along any potential rail improvement alignments. The typology locations in the study area are illustrated on Figure 3.4-1.

Developed land use categories consist of individual medium- and low-density residential zones, schools, hospitals, parks, and other unique institutional receptors such as museums, libraries, etc. Residential land uses were chosen for the typologies for new and shared corridors that varied in local zoning densities, ambient noise conditions, set back distances from the alternative corridors, and rail operational speeds. Institutional uses as mentioned above and parks were individually identified for each focused study. These representative typologies were evaluated on the topics listed below.

- Verification of screening distances (noise and vibration).
- Effectiveness of noise barriers.
- Benefits from elimination of grade crossings.

Verification of Screening Distances (Noise and Vibration): The results of the representative typologies confirm that the screening method used an appropriate upper boundary as an indicator of potential for noise impact. Impacts were found to occur in 80% of the cases identified in the screening procedure; in 70% of those studied, consideration of mitigation may be appropriate. Those that would have insignificantly low noise impact were either at outer edges of the screening distance or were shielded sufficiently by other buildings. Shielding by terrain features or buildings is not taken into account in the screening process, except to indicate some receptors would not need further analysis.

Representative studies were also completed that assess the range of the potential vibration impact levels that are likely to be encountered in project-level analyses. The results generally show that the nearer buildings would be to a proposed alignment, the greater the likelihood of impact. Where speeds are expected to be low, the vibration potential impacts are confined to within 100 ft (30 m) of the track. At top speeds, the potential impacts extend to 200 ft (61 m). The special typologies generally validate the vibration screening distances that are included in Table 3.4-A2 in Appendix 3.4-A.

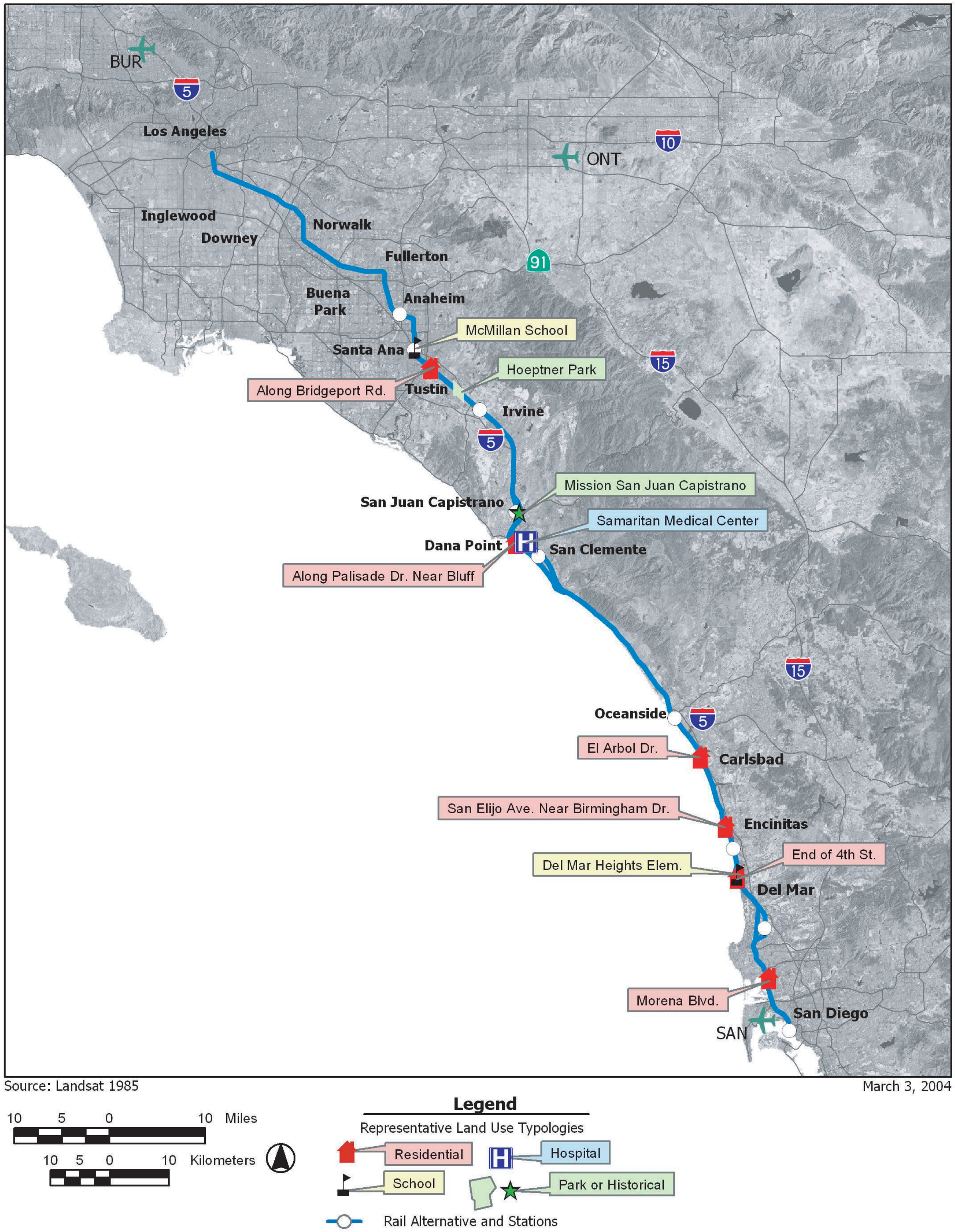

FIGURE 3.4-1

Noise and Vibration Land Use Typologies LOSSAN Region

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Effectiveness of Noise Barriers: The representative typology studies generally indicated that mitigation by sound barrier walls can be an effective means of reducing the potential impacts by one category, for example, from severe impact (mitigation appropriate) to impact. Noise barrier mitigation is shown to be especially effective for receivers close to the tracks. While noise barrier walls would not be the only potential mitigation strategy to be considered, they were used to represent mitigation potential in this Program EIR/EIS.

Benefits from Elimination of Grade Crossings: The representative typology studies were also used to estimate the potential benefit of noise reduction resulting from grade separations. A focused noise study was done for the existing grade crossing at Tamarak Street in Oceanside. Assessment of noise impact from horns at grade crossings was performed with FRA's horn noise model and annoyance based criteria. The study showed that the elimination of horn blowing by commuter trains at this grade crossing would result in a 77 percent reduction in the number of people impacted within 0.25 mi (0.40 km) of that intersection. Although results would vary depending on the local population density and proximity of residences and other sensitive land uses at each grade crossing, the Oceanside study illustrates the magnitude of the potential change to be expected if the sounding of horns and bells at existing rail crossings could be eliminated.

Removing all potential remaining horn noise would not eliminate noise impacts, however, because the sound of the trains would remain. The proposed Rail Improvements Alternative would add some noise to that of the existing (2003) trains using the railroad corridor, due to the projected increase in the number of trains in the corridor by 2020. (This increase over existing conditions would also occur under the 2020 No Project Alternative.) Nonetheless, there would be a clear benefit from the elimination of the horns and warning signals.

Based on these results, the potential noise impact ratings from screening were adjusted to account for segments where grade crossings would be eliminated for existing passenger and freight trains as part of the implementation of the Rail Improvements Alternative along that segment. A reduction of one impact rating level (high to medium or medium to low) was made for segments where a proposed alignment option would eliminate horn and bell noise due to grade separation.

This adjustment was made on the segments listed below.

- Fullerton to north of San Juan Capistrano.
- Oceanside to Solana Beach.
- University Towne Centre to the northern portion of Mission Bay.

3.4.2 Affected Environment

A. STUDY AREA DEFINED

The study area for the noise and vibration assessment is defined by the screening distances that are used by the FRA (U.S. Department of Transportation 1998) and FTA (U.S. Department of Transportation 1995) to evaluate rail corridors. The study area is within 1,000 ft (305 m) of the centerline of the rail improvement alignment options.

B. GENERAL DISCUSSION OF NOISE AND VIBRATION

This section describes the characteristics and associated terms and measurements used for transportation-related noise and vibration. When noise from a train or highway reaches a receptor, whether it is a person outdoors or indoors, it combines with other sounds in the environment (the ambient noise level) and may or may not stand out in comparison. The distant sources may include traffic, aircraft, industrial activities, or sounds in nature. These distant sources create a background noise in which usually no particular source is identifiable and to which several sources may contribute, but is fairly constant from moment to moment and varies slowly from hour to hour. Superimposed on this slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. Examples include the passing of a train, the over flight of an airplane, the sound of a horn or siren, or the screeching of brakes. These single events may be loud enough to dominate the noise environment at a location for a short time, and when added to everything else, can be an annoyance. The descriptors used in the measurement of noise environments are summarized below.

The fundamental measure of noise is the decibel (dB), a unit of sound level based on the ratio between two sound pressures—the sound pressure of the source of interest (e.g., passenger and freight trains) and the reference pressure (the quietest sound that a human can hear). Because the range of actual sound pressures is very large (a painful sound level can be over 1 million times the sound pressure of the faintest sound), the expression of sound is compressed to a smaller range with the use of logarithms. The resulting value is expressed in terms of dB. For example, instead of a sound pressure ratio of 1 million, the same ratio is 120 dB.

The human ear does not respond equally to high- and low- pitched sounds. In the 1930s, acoustical scientists determined how humans hear various sounds and developed response characteristics to represent the sensitivity of a typical ear. One of the characteristics, called the *A-curve*, represents the sensitivity of the ear at sound levels commonly found in the environment. The A-curve has been standardized. The abbreviation dBA is intended to denote that a sound level is expressed as if a measurement has been made with filters in accordance with that standard.

- *Maximum Sound Level (L_{max}),* measured in dBA, is the highest noise level achieved during a noise event.

- *Equivalent Sound Level (L_{eq})*, measured in dBA, describes a receptor's cumulative noise exposure from all noise events that occur in a specified period of time. The hourly L_{eq} is a measure of the accumulated sound exposure over a full hour. The L_{eq} is computed from the measured sound energy averaged over an hour (nothing one would read from moment to moment on a meter) representing the magnitude of noise energy received in that hour. FHWA uses the peak traffic hour L_{eq} as the metric for establishing highway noise impact.

- *Day-Night Sound Level (L_{dn})* describes a receptor's cumulative noise exposure from all noise events that occur in a 24-hour period, with events between 10 p.m. and 7 a.m. increased by *10* dB to account for greater nighttime sensitivity to noise. The L_{dn} is used to describe the general noise environment in a location, the so-called "noise climate." The unit is a computed number, not one to be read from moment to moment on a meter. Its magnitude is related to the general noisiness of an area.

EPA developed the L_{dn} descriptor and now most federal agencies, including the FRA, use it to evaluate potential noise impacts. Typical L_{dns} in the environment are shown in Figure 3.4-2.

- *CNEL*, a variant of L_{dn}, is used in noise assessments in California. Rather than dividing the day into two periods, daytime and nighttime, CNEL adds a third period to account for increased sensitivity to noise in the evening when people are likely to be engaged in outdoor activities around the home. An evening addition of 5 dB is applied to noise events between the hours of 7 p.m. and 10 p.m. to reflect the additional annoyance noise causes at that time. In general, the difference between Ldn and CNEL is slight and the two measures will be considered interchangeable for purposes of this noise analysis.

The way people react to noise in their environment has been studied extensively by researchers throughout the world. Based on these studies, noise impact criteria have been adopted by the FRA (U.S. Department of Transportation 1998) and other federal agencies to assess the contribution of the noise from a source like conventional rail to the existing environment. The FRA bases noise impact criteria on the estimated increase in L_{dn} (for buildings with nighttime occupancy) or increase in L_{eq} (for institutional buildings) caused by the project for direct and indirect impacts. Criteria are discussed in Section 3.4.1 and Appendix 3.4-C.

Transportation Noise

Noise from highways and rail lines tends to dominate the noise environment in their immediate vicinity. Each mode has distinctive noise characteristics in both shape and source levels. Highway and rail noise affects an area that is linear in shape, extending to both sides of the alignment. Individual highway vehicles are generally relatively quiet, but the accumulation of noise from the volume of traffic throughout the majority of the day and night results in a nearly continuous high sound level. Noise from road traffic is generated by a wide variety of vehicle types, makes, and models. In general, the noise associated with highway vehicles can be divided into three classes of vehicle: automobiles, medium trucks, and heavy trucks. Each class has its own noise characteristic depending on vehicle type, speed, and the condition of the roadway surface.

Train Noise and Vibration: If the Rail Improvements Alternative were implemented, higher operating speeds for passenger rail operations on the LOSSAN corridor of up to 125 mph (200 kph) would be possible for the less constrained areas, in terms of alignment (i.e., flat and straight). In contrast, much lower operating speeds would be expected in the more developed areas. Noise from a train can be expressed in terms of a source-path-receptor framework. The source of noise is the train moving on its tracks. The path describes the intervening course between the source and the receptor wherein the noise levels are reduced by distance, topographical and human-made obstacles, atmospheric effects, and other factors. Finally, at each receptor, the noise from all sources combine to make up the noise environment at that location.

The total noise generated by a train is the combination of sounds from several individual noise-generating mechanisms, each with its own characteristics, including location, intensity, frequency content, directivity, and speed dependence. These noise sources can be grouped into two categories according to the speed of the train.

For low speeds, below about 40 mph (64 kph), noise emissions are dominated by the propulsion units, cooling fans, and under-car and top-of-car auxiliary equipment such as compressors and air conditioning units.

In the speed range from 60 mph to about 150 mph (98 kph to 241 kph), mechanical noise resulting from wheel/rail interactions and structural vibrations dominate the noise emission from trains. In the existing LOSSAN rail corridor, trains seldom exceed 79 mph (127 kph), so this speed range is the top end of noise characteristics for trains with which most people are familiar.

Noise from trains also depends on the type and configuration of its track structure. Typical noise levels are expressed for conventional rail at grade on ballast and tie track. For trains on elevated structure, train noise is increased, partially due to the loss of sound absorption by the ground and partially due to extra sound radiation from the bridge structure. Moreover, the sound from trains on elevated structures spreads about twice as far as it does from at-grade operations of the same train, due to raising the sound source higher above ground.

Horns are an example of a train noise source that is a dominant noise source at any speed. Audible warnings at grade crossings, including train horns and warning bells, are a common feature of conventional trains and a vital safety component of railroad operations. These noise sources often prove to be a source of annoyance to people living near railroad tracks. Elimination of horns and bells at existing grade crossings would provide a noise benefit associated with the implementation of the Rail Improvements Alternative for some alignment options along the existing LOSSAN corridor.

Ground-borne vibration from trains refers to the fluctuating motion experienced by people on the ground and in buildings near railroad tracks. In general, people are not commonly exposed to vibration levels from outside sources that they can feel. Little concern results when a door is slammed and a wall shakes or something heavy is dropped and the floor shakes momentarily. Concern results, however, when an outside source like a train causes homes to shake. The effects of ground-borne vibration in a building located close to a rail line could at worst include perceptible movement of the floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. None of these effects is great enough to cause damage, but could result in annoyance if repeated many times daily.

As with noise, ground-borne vibration can be understood as following a source-path-receptor framework. The source of vibration is the train wheels rolling on the rails. They create vibration energy that is transmitted through the track support system into the track bed or track structure. The path of vibration involves the ground between the source and a nearby receptor such as a building.

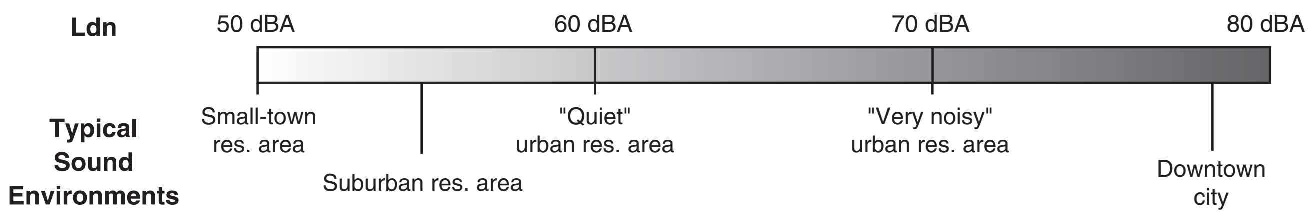

FIGURE 3.4-2

Typical Day-Night Sound Level Environments

Mode Noise Level Comparisons

Noise levels of typical individual transportation vehicles are compared in Figure 3.4-3 with each other and with other commonly experienced sounds in the environment. Jet aircraft are clearly the noisiest of the transportation sources, followed by train horns and diesel trucks. Noise levels of freight and commuter trains at speeds of 50 to 80 mph (80 to 129 kph) are similar to high-speed trains at speeds of 100 to 150 mph (161 to 200 kph). The descriptor for the figure is the L_{max} which represents the highest sound level associated with a single event such as the passage of a train, aircraft, or truck.

As described above, the descriptor used in environmental assessments is the L_{dn}, which represents the cumulative noise exposure during a 24-hour period, rather than the L_{max}. A comparison of noise associated with surface transportation sources at various distances on either side of an unobstructed highway or railway is shown in Figure 3.4-4. This example is based on conventional passenger and freight trains at typical operating speeds compared with high-speed trains at a range of speeds, for a hypothetical situation of one train per hour. The graph shows the relative differences between these types and speeds of trains in terms of cumulative noise exposure. The graph also includes the cumulative noise levels over a 24-hour period of an 8-lane freeway with traffic traveling at 65 mph (105 kph) in relation to the train examples.

The graph in Figure 3.4-5 shows the difference in cumulative noise exposure for the same train types and speeds given typical frequency levels. Commuter trains are assumed to have much higher frequencies than freight trains based on existing rail operations in the LOSSAN Corridor. For this illustration commuter trains are assumed to have 46 day- and 28 night-trains made up of 1 locomotive and 5 coaches; and freight trains are assumed to have 10 day- and 3 night-trains made up of 2 locomotives and 40 freight cars. The 8-lane freeway in this and the preceding plot is assumed to carry 1,885 vehicles/hour/lane with 2% medium trucks and 3% heavy trucks. This example shows that as commuter train frequencies and speeds are increased the noise exposure is increased relative to the existing rail services on the LOSSAN Corridor. Again, the graph includes the cumulative noise levels of a typical 8-lane freeway with traffic traveling at 65 mph (105 kph) in relation to the train examples. This example also shows how the cumulative noise diminishes with distance from the linear-type surface transportation sources. In the first 300 ft (91 m) from the centerlines, L_{dn} from rail sources tends to diminish more with respect to distance than that from a busy freeway. The freeway constitutes a continuous long source of noise, whereas a rail line has a series of transient noise events with relatively short sources.

C. NOISE ENVIRONMENT IN THE STUDY AREA

Regional noise and vibration environments are generally dominated by transportation-related sources, including vehicle traffic on freeways, highways, and other major roads, existing passenger and freight rail operations, and aviation sources, including civilian and military. Existing noise along highway and rail corridors has been estimated using data in the noise element from the general plan for cities and counties in the project area, along with general methods provided by FHWA, FRA, and FTA for estimating transportation noise. Ambient noise levels are characterized in the section below. Ambient vibration conditions are very site-specific in nature and are not characterized as part of the program environmental process.

The project region includes a portion of the Los Angeles basin and the coastal areas of southern California between Los Angeles and San Diego, generally following the existing LOSSAN rail corridor. The ambient noise in the northern portion of the region is dominated by motor vehicle traffic in densely populated areas and along freeways.

Along the LOSSAN corridor south from Union Station, existing passenger service (Amtrak, Metrolink, and Coaster) and freight rail contribute to the local noise. Throughout this portion of the region, roadway traffic also contributes to the ambient noise. In Los Angeles and northern Orange counties, freight rail and motor vehicle traffic comprise the sources of ambient noise. Along the coast, local roadway traffic and passenger rail service contribute to the ambient noise conditions, most notably horn blowing at grade crossings. Freeway noise is the dominant noise source in this region.

In the urban areas and suburban areas of Los Angeles and northern Orange counties, the ambient noise ranges from L_{dn} 63 to 68 dBA depending on the proximity to noise sources such as rail, roadways and airports. In the more suburban areas of the region, the ambient noise ranges from 58 to 63 dBA. Along the coast, the ambient noise environment ranges from L_{dn} 54 to 64 dBA depending on proximity to local noise sources.

For this program-level assessment, sensitive noise receptors in the study area were defined as residences, schools, hospitals and other medical care facilities, parks, historic structures, and other unique institutional receptors such as libraries and museums. These uses are prevalent throughout the study area, and are more concentrated along the urban parts of the corridor. These uses were not mapped in the study area at this program level, but representative receptors were specifically identified for the screening analysis for noise. Sensitive receptors used in the screening analysis were shown previously on Figure 3.4-1.

The existing LOSSAN rail corridor was established before most of surrounding land uses, and in many instances sensitive receptors are at least partially buffered by other uses from the rail corridor. New development expected within the study area was also planned with the existing rail corridor in mind, so it is expected that most future sensitive receptors would not be directly adjacent to the rail corridor.

3.4.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The No Project Alternative includes programmed and funded transportation improvements that will be implemented and operational by 2020 in addition to the existing conditions. These improvements are not major system-wide capacity improvements (e.g., major new highway construction or widening) and will not result in a general improvement of intercity travel conditions across the study area.

For purposes of this analysis, it is assumed that there will be no additional noise and vibration impacts associated with the development of the programmed projects included under the No Project Alternative, as compared to existing conditions. The potential significant impacts associated with programmed projects would be addressed with mitigation measures in a manner consistent with existing conditions in accordance with the project-level environmental documents and approvals for the projects as prepared by the project sponsors. While the implementation of the No Project Alternative may result in some increases, any estimate of such increases would be speculative.

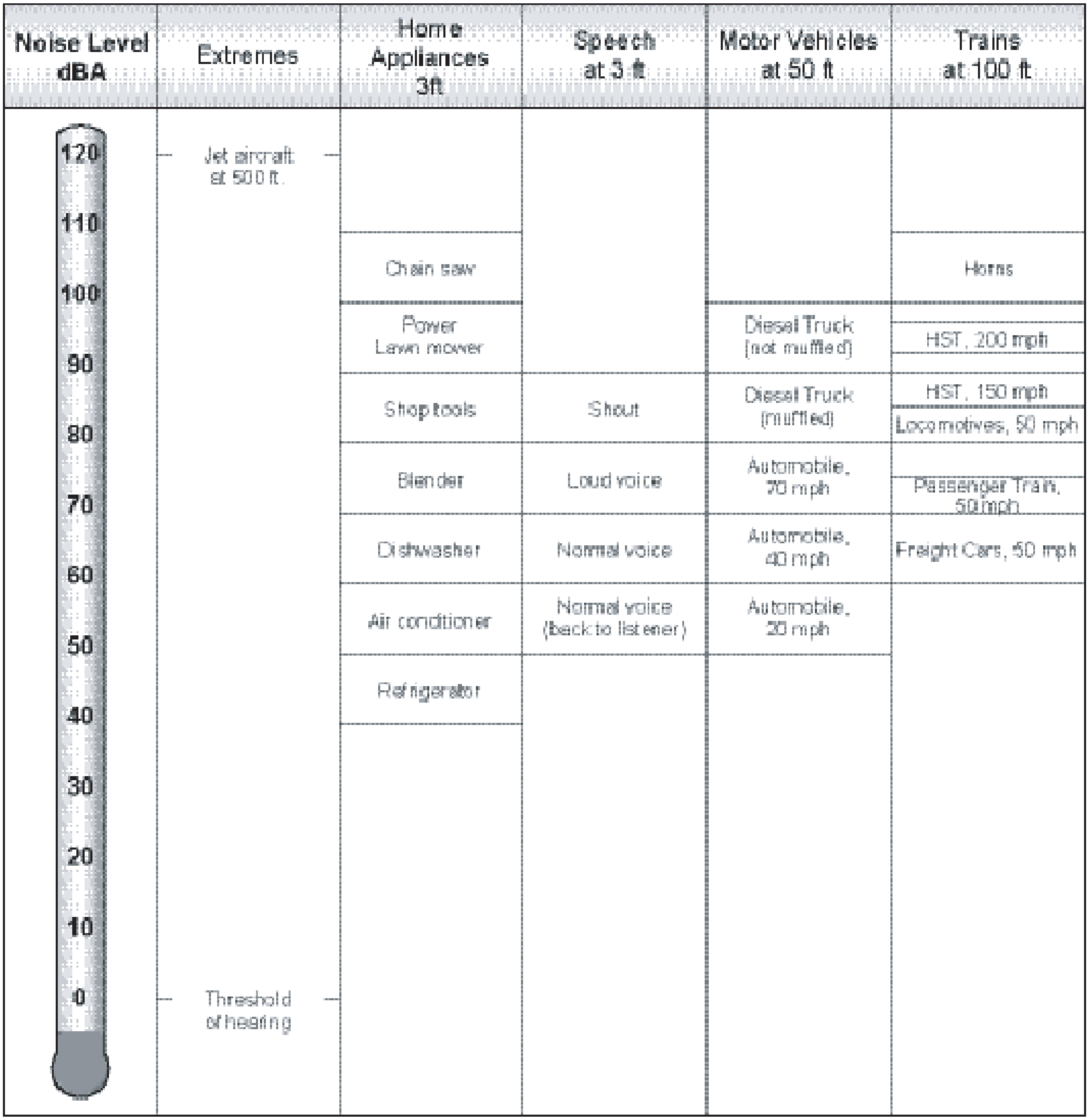

FIGURE 3.4-3

Typical L_{max} Values

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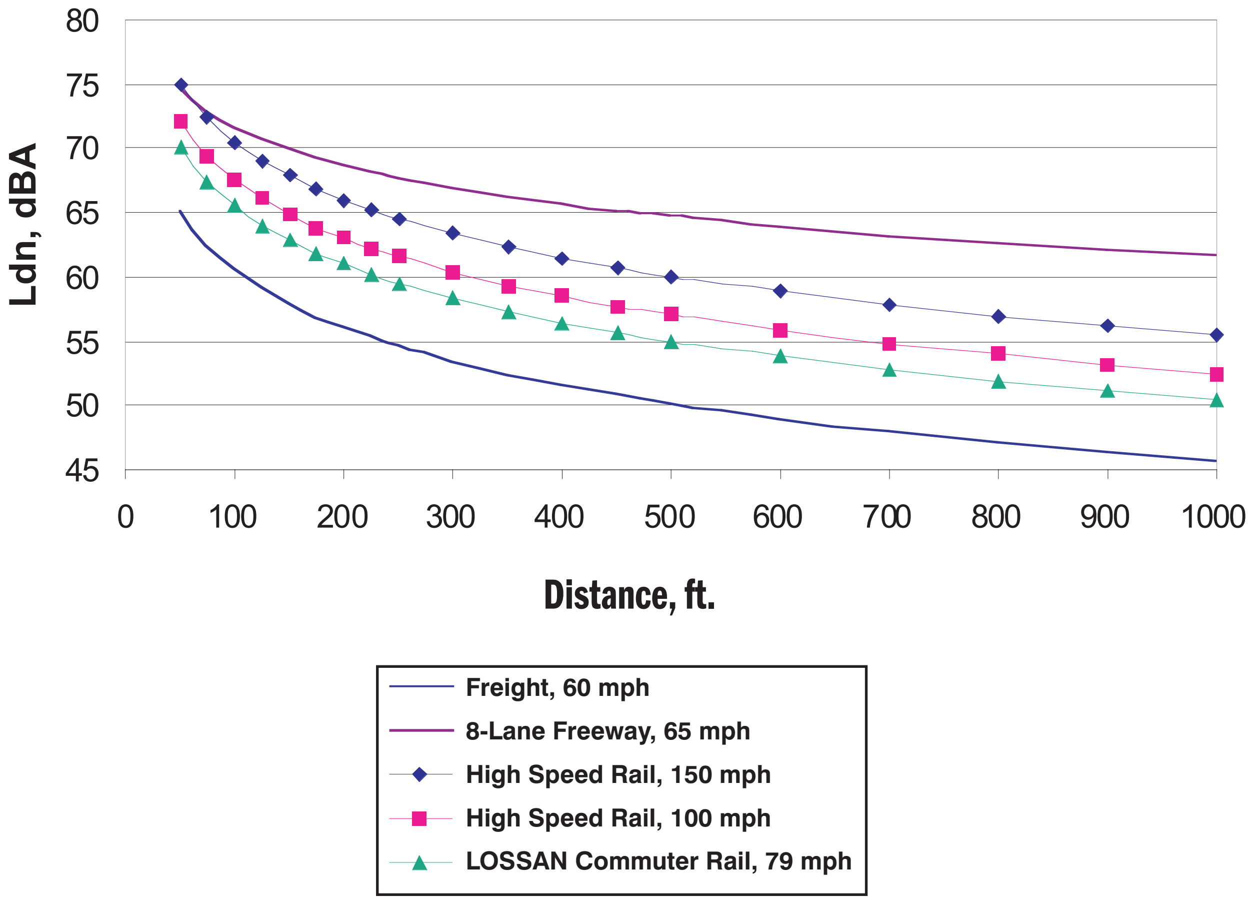

FIGURE 3.4-4

Example of Noise Exposure vs. Distance with Typical Frequencies

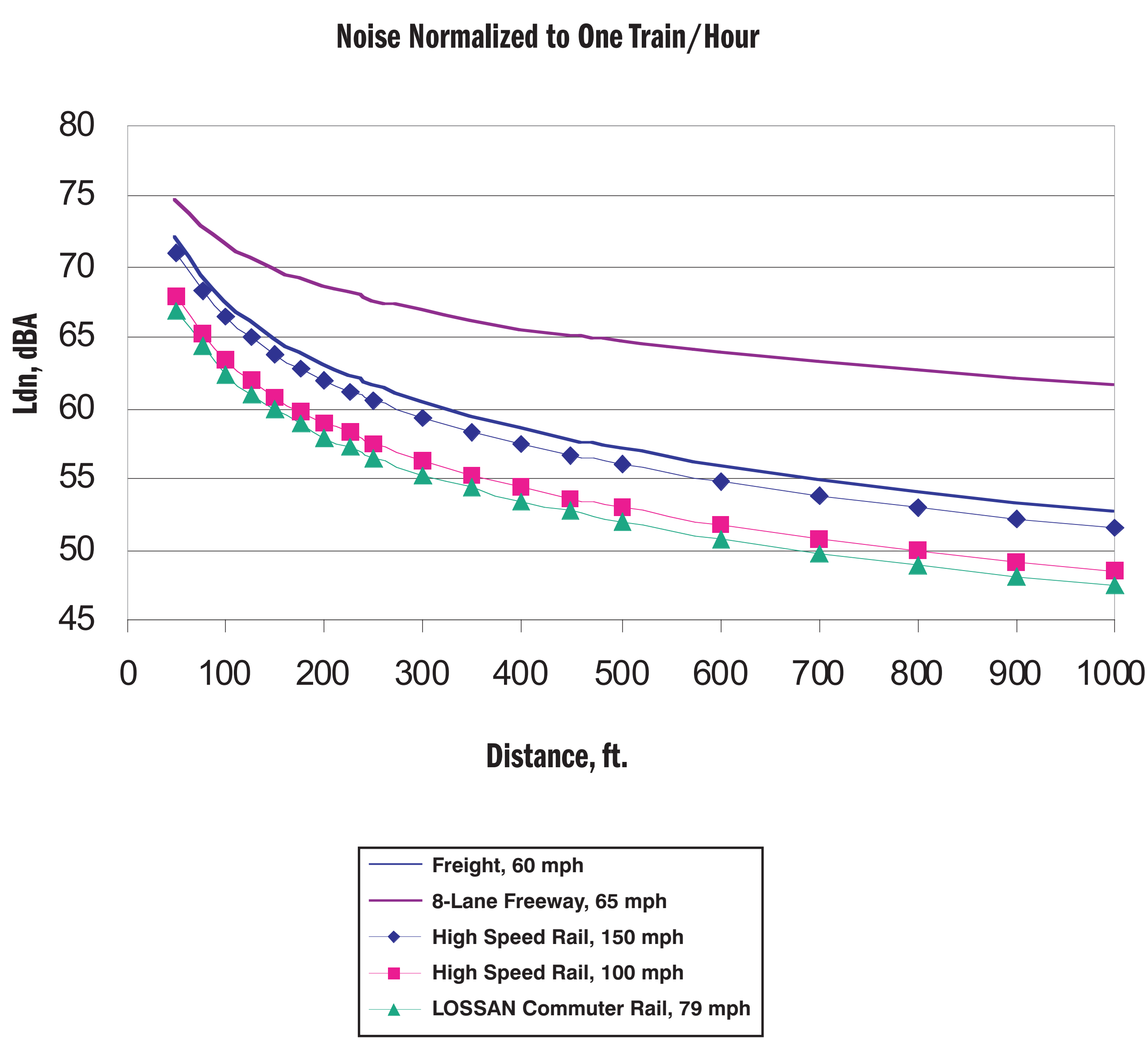

FIGURE 3.4-5

Example of Noise Exposure vs. Distance with Normalized Frequency

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Beyond the potential noise and vibration impacts for programmed improvements (to be addressed in other project-level documents), the No Project Alternative potentially would have additional noise impacts on sensitive land uses along the LOSSAN rail corridor. As described in Chapter 1, *Purpose and Need*, passenger rail service in the corridor is projected to nearly double between now and 2020, independent of the proposed rail improvements. The No Project Alternative would leave the rail corridor at grade along much of its length. With the projected increase in numbers of passenger and freight trains in the corridor, there would be a substantial increase in the noise from train horns and warning bells at grade crossings, compared with existing conditions.

The No Project Alternative also would result in increases in nighttime noise and vibration along the corridor, particularly between Union Station and Fullerton. These increases would result from the need to shift more freight rail operations to the overnight hours in order to accommodate the 2020 projected increase in daytime passenger rail traffic (see Chapter 4 for more discussion). Because noise and vibration are more discernible and annoying during nighttime hours, an increase in nighttime freight operations could have potentially significant impacts on sensitive land uses along the corridor, including residential and commercial (e.g., hotels and motels) areas.

B. NO PROJECT COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Potential direct noise impacts include increases in the ambient noise near sensitive receptors such as residences, schools, hospitals, and other areas where people live, sleep, or generally expect relative quiet. Potential indirect impacts may include an increase in noise levels that alter the overall setting of historic structures, or that occur in relatively quiet open-space and wildlife habitat areas. During construction, temporary increases in ambient noise levels may occur from construction equipment and increased truck traffic. These temporary impacts may be more pronounced if construction occurs during nighttime hours when the ambient noise levels are lower.

The No-Project Alternative is used as the basis for comparison of potential noise impacts. It is assumed that any impacts associated with the proposed Rail Improvements Alternative would be in addition to No Project conditions.

The relative level of potential noise impacts for the Rail Improvements Alternative is illustrated in Figure 3.4-6. The figure shows the relative noise impacts in terms of high, medium and low categories for all of the alignment options. The potential noise impact ratings account for the reduction of horn and bell noise associated with the elimination of grade crossings on the existing LOSSAN rail line, where appropriate. As shown in the figure, only the rail section between Fullerton and Irvine (approximately 20 mi [32 km]) would have potentially high noise impacts attributable to the proposed Rail Improvements Alternative.

South of San Clemente the noise impact rating for conventional rail improvements would be low due to the presence of the U.S. Marine Corps base at Camp Pendleton. Through this area, rail service could reach speeds up to 125 mph (200 kph). At Oceanside the I-5 rail alignment would encounter higher population densities and would represent medium potential impact from there through Encinitas. Maximum speeds south of Oceanside would not be expected to exceed 100 mph (161 kph). All alignment options from Encinitas to San Diego would have a low noise impact rating.

Overall, the LOSSAN corridor would benefit from grade crossing eliminations that would be part of the proposed improvements. A major benefit is the elimination of horn noise at the grade crossings. Horn noise dominates the area within 0.25 mi (0.40 km) of a grade crossing, such that its elimination would more than make up for any increased train noise due to higher speeds or more frequent service. It is estimated that potential noise impacts can be reduced by approximately 80 percent at adjacent receptors by eliminating freight and passenger train horns, according to the focused noise study results performed at a grade-crossing site in Oceanside.

South of Irvine, the higher-level rail improvement options would result in a fully grade separated LOSSAN rail alignment. The communities along the LOSSAN alignment would receive benefits from full grade separation by the elimination of warning bells and train horn noise from existing services (Amtrak, Metrolink, and freight) along this heavily used rail line. In contrast, the lower-level rail improvement options would result in continued noise impacts without the benefits of full grade separation.

Potential noise impacts and key differences between alignment options are summarized below.

Between Los Angeles Union Station and Fullerton, communities along the LOSSAN alignment would receive benefits from full grade separation due to the elimination of warning bells and train horn noise from existing services (Amtrak, Metrolink, and freight) along this heavily used rail line. Between Fullerton and Irvine, the trenching option also would result in a fully grade-separated LOSSAN rail alignment. The communities of Orange, Santa Ana, and Tustin would benefit from full grade separation and the elimination of warning bells and train horn noise. In contrast, the at-grade option in this rail segment would permit additional frequencies of service and higher speeds, which would have additional noise impacts without the benefits of grade separation.

Based on the program-level noise assessment, both alignment options within San Juan Capistrano would have a low impact rating for noise. However, the Trabuco Creek option would be expected to have more impact than the tunnel under I-5. Trabuco Creek would be at-grade on the edge of the historic district, while the I-5 option would completely bypass historic San Juan Capistrano.

The long tunnel option through San Clemente would have a low potential for impacts since it completely removes the LOSSAN alignment from the sensitive coastal communities, and would place it in a deep tunnel under I-5. The short tunnel option is ranked as having medium potential impacts. This option would remove the LOSSAN alignment from the beach along San Clemente, resulting in significant benefits to that community. However, the short tunnel option would continue to utilize the coastal alignment along Dana Point. While there could be some noise improvement from the partial grade separation (elimination of warning bells and train horns), this corridor segment would continue to be a source of rail noise.

The short trench option through Carlsbad would have fewer potential noise impacts for downtown Carlsbad than the option to leave several crossings at grade through downtown near the Carlsbad Coaster Station. The short trench concept would eliminate the train horn noise and remove the warning bells at the existing at-grade crossing. It would also place part of the alignment underground in a cut-and-cover tunnel, reducing train noise through the center of this coastal community. Leaving several crossings at grade through the town center would result in continued noise impacts.

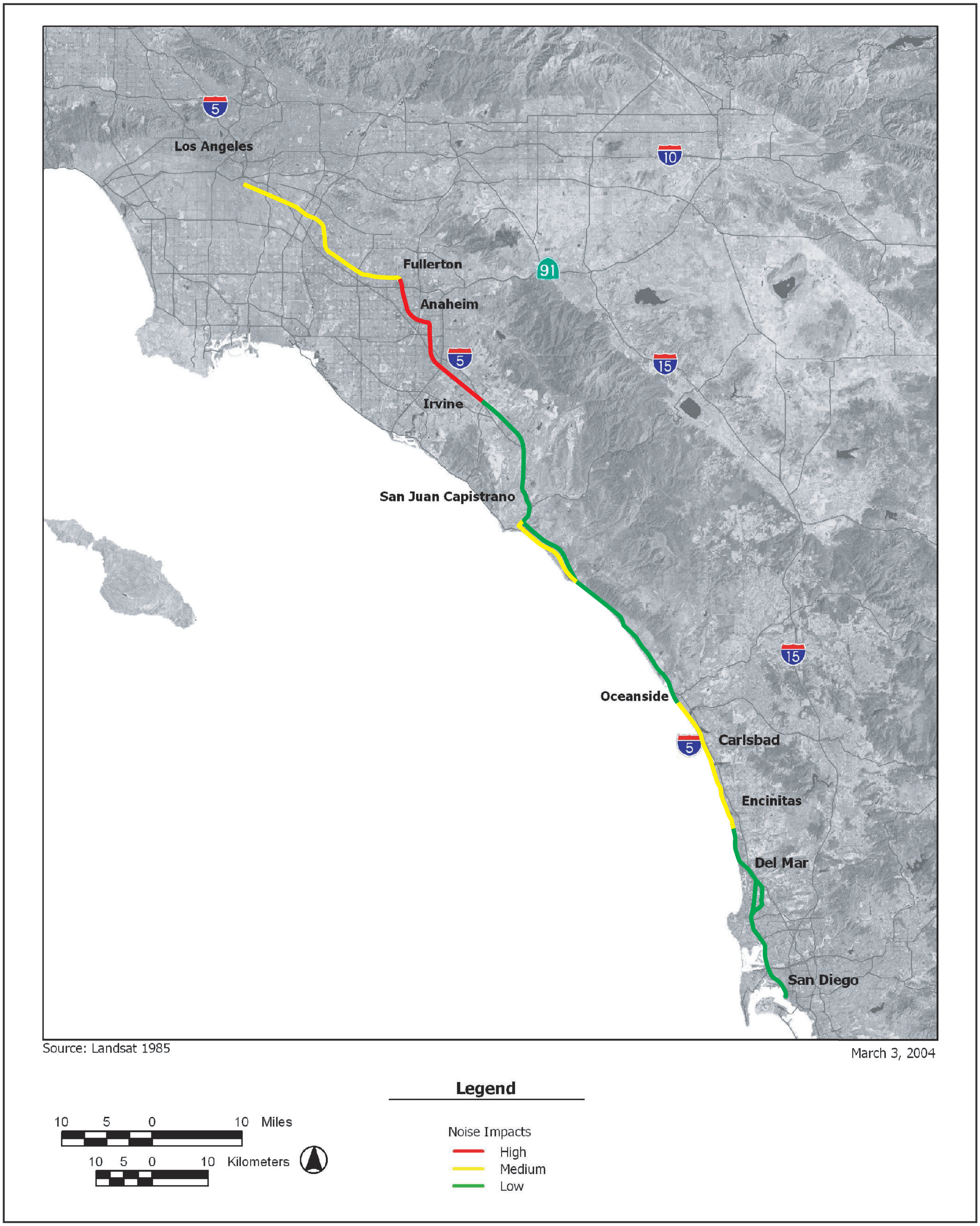

FIGURE 3.4-6

Potential for Noise Impacts

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Federal Railroad Administration

The short trench option through Encinitas, like Carlsbad, would have fewer noise impacts for downtown Encinitas than the option to leave several crossings at grade through downtown near the Encinitas Coaster Station. The short trench option would eliminate the need for train horn noise and remove the warning bells at the existing at-grade crossing. It would also place part of the alignment underground in a cut-and-cover trench, reducing train noise through the center of this coastal community. Leaving several crossings at grade through the town center would result in continued noise impacts.

Both of the tunnel concepts for Del Mar would be expected to have low potential noise impacts. While these options may result in some additional noise impacts (particularly at the portals for the I-5 tunnel, which would be located between two residential areas), both would provide considerable benefit to the community as a result of grade-separation improvements (the elimination of warning bells and train horn noise).

During construction, temporary noise impacts would occur in active construction zones and could affect residential, commercial and institutional uses along the rail corridor. These impacts would be higher if construction occurred during quieter times such as evenings and nights.

Increases in ambient noise levels near historic structures could potentially alter the historic setting. In quieter, open-space or wildlife areas, increased noise levels could degrade the quality of recreational activities. These potential indirect impacts are not likely to be substantial because the proposed rail improvements would be done along existing rail and highway corridors where the ambient transportation-related noise dominates the noise environment. Increases in noise due to increased rail service would be gradual, intermittent, and incremental, rather than sudden and sustained.

Vibration impacts are less predictable at a program level of analysis due to the site-specific nature of vibration transmission and variable soil conditions along the alignment. Generally, vibration impacts would occur in areas where the rail right-of-way and/or tracks would be moved closer to existing, sensitive receptors, depending on the underlying soil conditions. At this program level, it is estimated that the proposed Rail Improvements Alternative has the potential to create additional vibration impacts along up to approximately 40 mi (64 km), or about 30 percent of the corridor. These areas include the following.

- Parts of the Union Station to Fullerton segment, where additional tracks would move the existing rail corridor slightly closer to sensitive receptors.
- The Trabuco Creek alignment in San Juan Capistrano, where new rail corridor would be constructed along the east side of the creek.
- The Dana Point curve realignment/short tunnel option, where straightening the curve would move the tracks closer to some receptors and would remain at grade.
- The alignments through Carlsbad and Encinitas, where a second track would move the existing rail corridor slightly closer to sensitive receptors.

3.4.4 Mitigation Strategies

General mitigation strategies are discussed in this programmatic review of potential noise impacts associated with proposed alignment options. Specific mitigation for expected noise and vibration impacts would be developed in the next stage of environmental analysis. Noise and vibration mitigation measures can generally be applied to the source (train and associated structures), the path (area between train and receiver) and/or the receiver (property or building).

Treatments such as sound insulation or vibration controls to impacted buildings may be difficult to implement for the potentially numerous properties adjacent to the right-of-way. Such treatments require protracted implementation procedures and separate design considerations. The most feasible and effective mitigation treatments are typically those involving the path. These mitigation measures can often be applied to the path within the right-of-way, adjacent to the tracks. Potential noise impacts can be reduced by the installation of sound barrier walls constructed to shield receivers from train noise. For vibration mitigation, a number of track treatments may be considered for reducing train vibrations. The appropriateness of treatments would depend on the site-specific ground conditions found along the corridor. This program-level analysis has identified areas where potential project-induced vibrations should be assessed in the future.

A. NOISE BARRIERS

Noise barriers are often a practical way to reduce noise impacts from transportation projects including rail corridors. The representative typologies considered mitigation with noise barriers for certain areas. In most cases the potential noise impacts could be reduced from the severe impact category to FRA's impact category, and to the no impact category in some locations, with the application of appropriately dimensioned noise barriers next to the tracks. The design of noise barriers appropriate for the rail right-of-way line would depend on the location and height of noise-sensitive buildings, as well as the speeds of the trains. Noise barriers 8 to 12 ft (2 to 3.7 m) tall might be used to reduce noise in noise-sensitive areas.

Application of mitigation to the Rail Improvements Alternative would result in a considerable reduction of potential noise impacts. The estimates obtained from the results of the representative typologies showed noise barriers to be effective in reducing the potential noise impact rating by one category, for example, from high to medium or from medium to low. Consequently, segments with a medium rating would be adjusted down to a low rating.

The cost of constructing a noise barrier on one side of a rail line is estimated at approximately $1 million per mi ($625,000 per km) for a concrete wall of 12 ft (4 m) in height. Specific mitigation would be developed as a part of project-level review, including a cost-benefit analysis and an assessment of other impacts that may be caused by noise walls (such as visual or land use impacts).

B. VIBRATION MITIGATION

Vibration mitigation is less predictable at a program level of analysis due to the site-specific nature of vibration transmission through soil conditions along the alignment. However, an estimate can be made of the length of corridor where special mitigation may need to be considered by totaling the segments with potential vibration impact rating of high. Preliminary estimates show that up to 40 mi (64 km) of the rail corridor could have vibration impacts, depending on site-specific soil conditions.

3.4.5 Subsequent Analysis

A. NOISE ANALYSIS

The FRA provides guidance for two levels of analysis in project environmental review, a general assessment method to quantify the potential noise impacts at locations with potential noise impacts, and a detailed analysis procedure for evaluating suggested noise mitigation at locations where general assessment shows there is potential for significant impacts. The process is designed to focus on problem areas as more detail becomes available during project development. Subsequent analysis would proceed along the following lines.

Ambient Noise Conditions

Ambient noise values would be measured at the project-level. A measurement program involving both long-term and short-term noise monitoring would be performed at selected locations to document the existing noise environment. As it would be impractical to measure everywhere, the monitoring would be supplemented by estimates of noise environments at locations considered to be typical.

Noise Propagation Characteristics

The next stage of analysis would incorporate topography as well as consideration of shielding by buildings, vegetation, and other natural features in a particular corridor

Impact Criteria

In the next stage of analysis, assessments using the full, three-level FRA and FTA impact criteria would be performed (U.S. Department of Transportation 1998 and 1995, respectively). This detailed assessment would specifically identify locations where potential impacts may occur and locations where potentially high impact may occur and would provide for consideration of specific mitigation measures where appropriate.

In project analysis, an assessment would also be done in the lagoon areas of northern San Diego County, to determine whether any potential noise impacts would adversely affect the wildlife resources. Potential impacts and mitigation strategies, if needed, would be assessed in consultation with agency representatives with specific knowledge of noise-related impact studies on wildlife in settings such as the lagoons.

Mitigation

As more detail becomes available in the project phase, there may be many areas that were identified as potentially impacted during screening analysis for which further analysis would not be needed, because they would not be impacted. The detailed analysis would provide information useful for the engineering design of mitigation measures. These measures would be considered in the project-level environmental review, and potential visual and shadow impacts of noise barriers would also be considered.

B. VIBRATION ANALYSIS

The steps involved in the project level analysis of ground-borne vibration would be similar to those for noise. The major difference would be the need for study of site-specific ground-borne vibration characteristics. Considerable variation of soil conditions may occur along the corridor, resulting in some locations with significant levels of vibration from trains and other locations at the same distance from the track where vibrations can hardly be perceived. Determining the potential vibration characteristics in the detailed analysis would involve a measurement program performed according to the method described in the FRA guidance manual (U.S. Department of Transportation 1998). This method would allow for the prediction of vibration levels and frequency spectrum information valuable not only in the assessment of impact, but also in the consideration of mitigation measures.

3.5 ENERGY

This analysis provides an overview of the potential operation and construction impacts associated with the use of energy for the No Project and Rail Improvements Alternative.

3.5.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Federal Regulations

Federal Energy Regulatory Commission: The Federal Energy Regulatory Commission (FERC) is an independent agency that regulates the interstate transmission of natural gas, oil, and electricity. FERC also regulates natural gas and hydropower projects. As part of that responsibility, FERC regulates the transmission and sale of natural gas for resale in interstate commerce, the transmission of oil by pipeline in interstate commerce, and the transmission and wholesale sales of electricity in interstate commerce. FERC also licenses and inspects private, municipal, and state hydroelectric projects; approves the sighting of and abandonment of interstate natural gas facilities, including pipelines, storage, and liquefied natural gas; oversees environmental matters related to natural gas and hydroelectricity projects and major electricity policy initiatives; and administers accounting and financial reporting regulations and conduct of regulated companies.

Transportation Equity Act for the 21st Century: The Transportation Equity Act for the 21st Century (TEA21), passed in 1998, builds on the initiatives established in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which was the prior authorizing legislation for surface transportation. The ISTEA identified planning factors for use by Metropolitan Planning Organizations (MPOs) in developing transportation plans and programs. Under the ISTEA, MPOs are required to “protect and enhance the environment, promote energy conservation, and improve quality of life” and are required to consider the consistency of transportation planning with federal, state, and local energy goals (U.S. Department of Transportation 2002).

Executive Order 12185, Conservation of Petroleum and Natural Gas (December 17, 1979, 44 F.R. § 75093): This executive order encourages additional conservation of petroleum and natural gas by recipients of federal financial assistance.

State Regulations

California Code of Regulations, Title 24, Part 6, Energy Efficiency Standards: Title 24, Part 6 of the California Code of Regulations, Energy Efficiency Standards promotes efficient energy use in new buildings constructed in California. The standards regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. The standards are enforced through the local building permit process. These standards may apply to any buildings (e.g., stations) constructed as part of or in association with the No Project and Rail Improvements Alternatives.

B. METHOD OF EVALUATION OF IMPACTS

This section explains the methodology used to evaluate the potential energy impacts and benefits attributable to operation (direct energy) and construction (indirect energy) of the alternatives under study. This section also explains the criteria used to determine whether a potential impact on energy consumption would be significant.

Direct Energy

Operational energy use is addressed both quantitatively and qualitatively. The estimated direct energy consumption related to locomotive traffic in the LOSSAN corridor is quantified for the No Project and Rail Improvement Alternatives, based on the changes that would occur between 2003 and 2020 in the number of locomotives traveling along the corridor. Regional changes in vehicular traffic are not addressed in this analysis. Although the Rail Improvement Alternative is expected to accommodate part of the demand for increased passenger rail service, the projected population and employment increase between now and 2020 would result in increased vehicular traffic as well. Therefore, the Rail Improvements Alternative would not have a significant effect on regional VMT.

The heat content of diesel fuel was used to convert gallons of fuel consumed to energy, measured in British thermal units (Btus). Overall direct energy (Btus) was then converted to equivalent barrels of crude oil to represent potential energy impact. (Btus are the standard units used by industry and government literature for such comparisons. Metric units for energy [i.e., Joules] are not used in this report.) Annual direct-energy consumption values for locomotive travel in the LOSSAN corridor were calculated for existing conditions and the No Project and Rail Improvements Alternatives, and compared.

The qualitative analysis of regional direct energy consumption considers the estimated effect that each alternative would have on localized vehicular and rail travel along the rail corridor, congestion and travel speeds, which would affect fuel efficiency and, therefore, energy use.

Indirect Energy

The indirect energy impacts considered here include two potential construction-related energy consumption factors, construction of proposed rail improvements and construction of secondary facilities.

Construction of Rail Improvements: The estimated construction-related energy consumption for the construction of rail tracks and support facilities under the Rail Improvements Alternative is quantified in this analysis, based on data gathered for typical heavy rail systems and a heavy rail commuter system, San Francisco Bay Area Rapid Transit District (BART). Projected construction-related energy consumption for the Rail Improvements Alternative is presented in Table 3.5-1. These estimates are appropriate for comparison purposes.

Table 3.5-1
Construction-Related Energy Consumption Factors for Rail Improvements

Type of Construction	Rural vs. Urban[a]	Factor (billions of Btus)
At grade	Rural[b]	12.29/one-way rail mi
	Urban[c]	19.11/one-way rail mi
Elevated	Rural[b]	55.46/one-way rail mi
	Urban[c]	55.63/one-way rail mi
Below grade (cut)	Rural[b]	117.07/one-way rail mi
	Urban[c]	163.14/one-way rail mi
Below grade (tunnel)	Rural[b]	117.07/one-way rail mi
	Urban[c]	328.33/one-way rail mi
Station	N/A[d]	78[e]/station

Notes:
[a] Differences between the construction-related energy consumption factors for urban and rural settings reflect differences in construction methods, demolition requirements, utility accommodation, etc.
[b] Estimates reflect typical rail system construction energy consumption.
[c] Estimates reflect BART system construction energy consumption as surrogate for rail construction through urban area.
[d] Discreet (i.e., non-alignment-related facilities) are not differentiated between rural or urban because the data used to develop the respective values were not differentiated as such. Some difference between the actual values might be expected.
[e] Value for construction of freight terminal. Used as proxy for unknown air gate and HST station consumption factors.

Sources:
U.S. Congressional Budget Office 1977
U.S. Congressional Budget Office 1982
Congressional Budget Office in Energy and Transportation Systems, Prepared for the Federal Highway Administration, Sacramento, CA, by California State Department of Transportation (California Department of Transportation 1983).

Energy consumption related to transportation of materials and equipment to and from the work site cannot be estimated without project-level implementation and construction plans.

Secondary Facilities: A *secondary facility* is a facility that consumes energy in the production of materials related to the project alternatives. For example, a factory that produces construction materials and machinery that would be used in the construction and maintenance of the alternatives' structures and attendant facilities would be a secondary facility. Potential impacts resulting from energy consumption of secondary facilities are discussed qualitatively. Consideration was given to whether nonrenewable resources would be consumed in a wasteful, inefficient, or unnecessary manner, (with special attention given to the efficiency of production of construction materials and machinery and the choices made regarding construction methodology and procedures, including equipment maintenance).

C. CRITERIA FOR DETERMINING SIGNIFICANCE OF IMPACTS

According to Appendix F of the CEQA Guidelines, the means to achieve the goal of conserving energy include (1) decreasing overall per capita energy consumption, (2) decreasing reliance on natural gas and oil, and (3) increasing reliance on renewable energy sources. The significance criteria discussed herein are used to determine whether the alternatives would have a potentially significant effect on energy use, including energy conservation.

The No Project Alternative is the primary basis against which potential impacts of the Rail Improvements Alternative is compared. Significant potential operational energy impacts would occur if the Rail Improvement Alternative would result in either substantial demand on statewide and/or regional energy supply, or a significant additional capacity requirement.

Significant potential construction-related energy impacts would occur if construction of the proposed rail improvements would consume nonrenewable energy resources in a wasteful, inefficient, or unnecessary manner. Implementation of the Rail Improvement Alternative would have a significant adverse effect if it, together with regional growth, would contribute to a collectively significant shortage of regional or statewide energy. By contrast, if the implementation of the alternative resulted in energy savings or alleviated demand on energy resources, the alternative would contribute to energy conservation and would have a beneficial effect.

3.5.2 Affected Environment

A. STUDY AREA DEFINED

The study area affected by energy use of the alternatives is defined as the LOSSAN rail corridor and the localized roadway system along the corridor that is affected by grade crossings with the rail corridor.

B. GENERAL DISCUSSION OF TRANSPORTATION ENERGY CONSUMPTION

Transportation accounts for a large portion of the California energy budget, with approximately 46% of the state's energy consumption resulting from the transport of goods and people. Between 1997 and 2020, according to the State Department of Finance, the state is forecasted to grow by about 11 million people, or approximately 30% (California Department of Finance 1998). During this same period, intercity travel is projected to grow by almost 40% to almost 215 million trips per year (California High Speed Rail Authority 2000). Although the average fuel economy of vehicles in the state has improved, the fuel savings achieved are overshadowed by the increased number of miles traveled and the marked shift in personal vehicle preference, from the standard passenger automobile (sedan) toward larger vehicles such as sport utility vehicles (SUVs) and pick-up trucks. Currently, California's 24 million automobiles consume more than 17 billion gal (64 billion L) of petroleum, most of which is consumed in southern California. The state is the third largest consumer of petroleum fuel in the world. Only the United States as a whole and the former Soviet Union exceed this volume. Because of this dependence on petroleum fuels, events in the international petroleum market can immediately and adversely affect the price and adequacy of California's fuel supply (California Energy Commission 1999).

Statewide, automobile trips account for over 84 percent of all intercity travel and over 58 percent of the longer trips. In Southern California, this is even more pronounced, as the automobile currently dominates intercity travel. Automobile travel between Los Angeles and San Diego is currently the second largest geographic travel market in the state, accounting for 34.9 million trips in 1997. Traffic volume on I-5, the major highway link between Los Angeles and San Diego, is expected to increase 18 percent between 2001 and 2025.

Currently, this intercity corridor is also the second busiest intercity rail corridor in the nation, carrying approximately 4,700 riders each day (1.7 million riders annually) along the entire Pacific Surfliner corridor from San Luis Obispo to San Diego (California Department of Transportation 2001). Of this service, the segment between Los Angeles and San Diego has a current daily ridership of 3,900 (1.4 million riders annually). Intercity rail travel is anticipating exponential growth within the next 20 years. In 2001, Amtrak's 20-Year Improvement Plan projected 2005 and 2020 ridership along the rail corridor from San Luis Obispo to San Diego, using the total travel demand growth and constant mode share. By 2005, ridership is forecast to increase to approximately 5,500 riders per day (2 million riders annually) and to 15,800 daily riders (5.77 million riders annually) by 2020.

The effects of transportation congestion on energy consumption and air emissions can be major. Automobiles are most efficient when operating at steady speeds of 35 mph to 45 mph (56 kph to 72 kph) with no stops (Oak Ridge National Laboratory 2002). Fuel consumption increases by about 30% when average speeds drop from 30 mph to 20 mph (48 kph to 32 kph), while a drop from 30 mph to 10 mph (48 kph to 16 kph) results in a 100% increase in fuel use. Studies estimate that approximately 10% of all on-road fuel consumed is a result of congestion (California Energy Commission 1990). Likewise, energy consumption by locomotives increases as rail corridors become more congested. Bottlenecks caused by single-tracked sections of the LOSSAN corridor (currently about 41 percent of the corridor between Los Angeles and San Diego) result in locomotive idling along the corridor. At-grade crossings in urban areas require speed reduction, and there are also speed restrictions in sensitive coastal areas such as San Clemente and Del. All of these factors decrease the efficiency of locomotive travel and increase energy consumption.

3.5.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

Operational (Direct) Energy

As described in Chapter 1, *Purpose and Need*, the volume of train traffic on the LOSSAN corridor is projected to nearly double by the year 2020. (Refer to Section 1.2.2-A, Travel Demand, for numbers of existing and projected trains in the corridor.) The number of locomotive miles (kilometers) traveled in the corridor will increase an estimated 85% by 2020, with passenger rail miles increasing 69% and freight rail miles increasing 95% above 2003 levels.

These changes in existing and future No-Project conditions will increase the energy consumption by locomotives in the project region. The estimated energy consumption change between 2003 and 2020 is shown in Table 3.5-2. As indicated in the table, the existing (2003) energy used to power the estimated 55.4 million passenger and freight rail miles (89.2 million km) in the LOSSAN corridor was 1,113,164 million Btus (MMBtus), or 191,925 barrels of oil. The 107.9 million passenger and freight rail miles (173.6 million km) estimated under the 2020 No Project Alternative would consume the equivalent of about 2,099,147 MMBtus, or 361,922 barrels of oil. This increase of 89% from existing to No Project conditions would be caused primarily by the projected population and employment increases. Because congestion levels under the No Project Alternative would likely be higher than they are under existing conditions, the increase in direct energy used in 2020 would be higher than the projected 89% increase.

Table 3.5-2
Annual Locomotive Operational Energy Consumption in the LOSSAN Corridor

Energy Consumption	2003 Existing	2020 No Project Alternative
Annual Rail Fuel Usage -- Gal (L) [a]		
Passenger Rail	2,123,797 (8,039,210)	3,594,912 (13,607,821)
Freight Rail	5,901,896 (22,340,447)	11,539,528 (43,680,575)
TOTAL RAIL FUEL USAGE	8,025,693 (30,379,657)	15,134,440 (57,288,397)
Annual Direct Energy Consumption (MMBtus) [b, c]		
Passenger Rail	294,571	498,614
Freight Rail	818,593	1,600,533
TOTAL DIRECT ENERGY CONSUMPTION	1,113,164	2,099,147
CHANGE IN DIRECT ENERGY CONSUMPTION (2003 – 2020)		985,983
Annual Energy Consumption (Barrels of Oil) [d]		
Passenger Rail	50,788	85,968
Freight Rail	141,137	275,954
TOTAL ENEGY CONSUMPTION	191,925	361,922
CHANGE IN TOTAL ENERGY CONSUMPTION (2003-2020)		169,997

Notes:
[a] Gallons (liters) of fuel are estimated as shown in Appendix 3.3-A for air quality.
[b] MMBtus = million Btus. One British thermal unit (Btu) is the quantity of energy necessary to raise one pound of water one degree Fahrenheit.
[c] Heat content of diesel fuel used for conversion to Btus = 138,700 Btus per gallon
[d] One barrel of crude oil is equal to 5.8 MMBtus.

Construction (Indirect) Energy

The No Project Alternative is based on the assumption that projects currently included in existing plans and programs, including local, state, and interstate transportation system improvements, would be implemented. It is assumed that construction of the projects included in the No Project Alternative would not result in the consumption of energy resources in a wasteful, inefficient, or unnecessary manner.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Operational (Direct) Energy

Rail service in the LOSSAN corridor is not predicted to increase over 2020 No Project levels as a result of the Rail Improvements Alternative. Therefore, there would be no difference in projected 2020 energy consumption due to a change in numbers of locomotives in the rail corridor between the No Project and the Rail Improvements Alternatives.

However, there would be other impacts on operational energy consumption for the Rail Improvements Alternative. The projected increase in rail traffic between now and 2020 would result in higher levels of congestion and delays in train traffic without the proposed improvements to the corridor. The existing rail service is subject to delays and congestion, particularly in segments where the corridor is single tracked. These bottlenecks would increase in severity as rail service increases over the next 20 years and beyond. The Rail Improvements Alternative would decrease the likelihood of delays along the corridor, which would decrease the energy consumption from idling locomotives. The proposed double tracking would also decrease locomotive idling time at existing LOSSAN stations as rail service increases. At this program level of analysis, it is not possible to quantify the potential for energy benefits of decreased congestion and locomotive idle time along the corridor.

The grade separations that would occur with many of the proposed improvement options would also contribute to an increase in fuel efficiency and a reduction in energy consumption from idling automobiles and trucks at grade crossings. These reductions from reduced vehicular waiting time at crossings would be greatest in the congested urban roadways in the metropolitan areas of Los Angeles, Orange County, and San Diego. The proposed double tracking through the study area could also reduce vehicular delays at crossings by allowing two trains to pass through a given area at the same time.

The Rail Improvements Alternative would be consistent with the California Energy Plan (CEC 1997), which encourages reduction of transportation related energy needs by means including efficient public transportation.

Construction (Indirect) Energy

Construction of the programmed and funded transportation improvements under the No Project Alternative would require less energy than construction of those improvements plus the Rail Improvements Alternative.

The Rail Improvements Alternative construction-related energy consumption would result in the one-time, non-recoverable energy costs associated with construction of at-grade, underground and aerial track, stations, and support facilities. Details regarding energy conservation practices have not been specified for the Rail Improvements Alternative, which has not been designed in detail, nor have construction methods and staging been planned at this time. Given the scope and scale of the improvements proposed, however, it is anticipated that the construction-related energy requirement would be substantial.

Table 3.5-3 shows estimates of potential construction-related indirect energy consumption for the Rail Improvements Alternative, based on a higher level route combination. (Higher level is defined as alignment options within each rail segment that would require the greatest construction effort, such as tunneling or trenches as compared with at-grade work.) The proportion of rural versus urban areas is based on visual interpretation of the alignment in the context of the California Atlas & Gazetteer (DeLorme 2000). For this analysis, 30 percent of the corridor was characterized as rural, and 70 percent as urban. As shown in the table, construction of the Rail Improvement Alternative would consume energy on the order of 14,066 billion Btus.

Table 3.5-3
Non-Recoverable Construction-Related Energy Consumption

Structure	Rural vs. Urban[a]	Facility Quantity	Energy Consumption (Billion Btus)
At Grade	Rural	38.55 mi (62.04 km)	473.78
	Urban	89.95 mi (144.76 km)	1718.94
Aerial Rail Tracks	Rural	6.74 mi (10.85 km)	373.80
	Urban	15.73 mi (25.31 km)	875.06
Below Grade (Cut)	Rural	5.68 mi (9.14 km)	664.96
	Urban	13.26 mi (21.34 km)	2163.24
Below Grade (Tunnel)	Rural	8.74 mi (14.07 km)	1023.19
	Urban	20.39 mi (32.81 km)	6694.65
New Rail Stations	N/A	1 station	78
Rail Improvements Alternative Total			14,065.62

[a] Differences between the construction-related energy consumption for urban and rural settings reflect differences in construction methods, demolition requirements, utility accommodation, etc. This analysis assumes improvements would be construction in 30 % rural areas and 70 % urban areas.

It is reasonable to assume that secondary facilities, such as those used in the production of cement, steel, etc., would employ all reasonable energy conservation practices in the interest of minimizing the cost of doing business. Industry in California reduced electricity usage (which is mostly generated by natural gas, a nonrenewable fuel) from 54.7 million megawatt hours (MWh) in 2000 to 52.2 million MWh in 2001, a 4.6 percent reduction, even as the state's population increased by 513,352, or 1.5% (California Energy Commission 2002d). Therefore, it can reasonably be assumed that construction-related energy consumption by secondary facilities would not consume nonrenewable energy resources in a wasteful, inefficient, or unnecessary manner under the Rail Improvement Alternative.

Construction of the Rail Improvements Alternative is anticipated to take about 10 years, beginning in 2005 and finishing in 2016. Construction would occur in stages, and some segments would be open for operation while others are still under construction. Given the scope and scale of the proposed improvements, it is anticipated that secondary construction-related energy requirements would be substantial.

Construction-related energy impacts of the Rail Improvements Alternative, both project and secondary, would potentially represent a significant use of nonrenewable resources.

3.5.4 Mitigation Strategies

This is a broad program-level analysis reviewing potential energy use and impacts related to the proposed rail improvements. If the proposed improvements were implemented, the project-level of analysis would include the following:

- Minimize grade changes in steep terrain areas to reduce the use of diesel fuel.
- Maximize intermodal transit connections to reduce automobile VMT related to the rail system.
- Develop and implement a construction energy conservation plan.
- Develop potential measures to reduce energy consumption during operation and maintenance activities.

3.5.5 Subsequent Analysis

Subsequent analysis would be required in project-level environmental documentation for some projects in the proposed Rail Improvements Alternative, if selected. Comprehensive traffic analysis for future conditions could be required to assess energy impacts in more detail.

Subsequent energy analysis at the project level would follow the methodology applied in this evaluation, but would employ more detailed traffic data for the energy consumption analysis. Energy consumption factors would be updated using the latest available published information. Detailed construction staging, sequencing, methods, and practices would be necessary to support a quantitative analysis of construction energy consumption.

3.6 LAND USE AND PLANNING, COMMUNITIES AND NEIGHBORHOODS, PROPERTY AND ENVIRONMENTAL JUSTICE

This section evaluates the potential impacts of the No Project and Rail Improvements Alternatives on land use compatibility, communities and neighborhoods, and property. This section also addresses environmental justice in accordance with the provisions of Executive Order (EO) 12898. This evaluation describes how existing conditions compare with the No Project Alternative and how the No Project Alternative compares with the potential impacts of the Rail Improvements Alternative, including a comparison among the alignment and station options.

3.6.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY PROVISIONS

Land Use, Communities and Neighborhoods, and Property

This section addresses the potential effects of each of the alternatives on existing and planned land uses. This section includes a discussion of the existing uses in and adjacent to areas where property acquisition may be needed for an alternative, an analysis of the changes to these uses which may occur with an alternative, a discussion of potential inconsistencies with land use plans, and identification of general mitigation strategies. The discussion of potential inconsistencies with planned land uses does not imply that the Department, a state agency, would be subject to such plans or local ordinances, either directly or through the NEPA or CEQA process. The information is provided in order to indicate potential land use changes that could result in potential environmental impacts.

Environmental Justice

EO 12898, known as the federal environmental justice policy, requires federal agencies to address to the greatest extent practicable and permitted by law the disproportionately high adverse human health and environmental effects of their programs, policies, and activities, on minority populations and low-income populations in the United States. Federal agency responsibilities under this EO also apply to Native American programs. Department of Transportation (DOT) Order 5610.2 on environmental justice defines “disproportionately high and adverse effect on minority and low-income populations” to mean an adverse effect that is predominately borne by a minority population and/or a low-income population, or will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population (DOT Order 5610.2, Appendix Definitions, subd.[g]).

The California Government Code defines environmental justice as the “fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies” (California Government Code § 65040.12[e]). There are no specific state procedures prescribed for consideration of environmental justice issues related to the proposed LOSSAN Corridor Rail Improvements Alternative.

B. METHODS OF EVALUATION OF IMPACTS

The analysis was conducted using existing U.S. Census 2000 tract information/data compiled in a geographic information systems (GIS) format, local community general plans or regional plans, and land use information provided by the planning agencies in the region. Existing and future conditions were described for the No Project Alternative by documenting existing information for existing and planned future land use policy in potential alignment and potential station areas, development patterns for employment and population growth, demographics, communities and neighborhoods, housing, and economics. The No Project Alternative was compared to the planned uses reflected in general plans and regional plans to see if it may result in potential effects on future development. The general and regional plans consulted for this section are listed in Chapter 11, *Sources Used in Document Preparation*.

The ranking systems described below were used to evaluate potential impacts for the alternatives for land use changes, land use compatibility, and property. Potential impacts on communities and neighborhoods were also considered. The presence of minority populations and low-income populations in the study area for the alternatives was identified in order to consider potential environmental justice issues. Because this is a program-level environmental review, the analysis of these potential impacts was performed on a broad scale to permit a comparison of relative differences between the alternatives and among the alignment options. Further evaluation of potential impacts would occur at the project-level environmental review, should a decision be made to proceed with the Rail Improvements Alternative.

Land Use Compatibility

The potential compatibility of the proposed alignment options with existing land uses is evaluated based on the potential sensitivity of various land uses to the changes which would result from the Rail Improvements Alternative, and the potential impact of these changes on existing and planned land uses. For example, homes and schools are more sensitive to changes that may result in increased noise and vibration (see Section 3.4, *Noise and Vibration*) or increased levels of traffic congestion (see Section 3.1, *Traffic and Circulation*). Industrial uses, however, are typically less sensitive to these types of changes because these changes interfere less with normal industrial activities. Because an area's sensitivity or compatibility is based in this analysis on the presence of residential properties, low, medium, and high levels of potential compatibility are identified based on the percentage of residential area affected, the proximity of the residential area to facilities included in the Rail Improvements Alternative, whether or not the proposed improvement would occur within the existing LOSSAN rail right-of-way, and the presence of local or regional uses and public services(such as parks, schools, employment centers, law enforcement, fire and emergency services). For proposed alignment options, land use compatibility was assessed using GIS layers and aerial photographs to identify proximity to housing and population, and to determine whether the alignments would be within or outside an existing right-of-way in the study area.

Potential impacts are considered low if existing land uses within a potential alignment or station site are found to be compatible with the land use changes that may result from the Rail Improvements Alternative. The type of improvement proposed would also affect the level of potential impact. For example, improvements that would be done within the existing rail right-of-way generally would be more compatible with existing land uses than those that would introduce a new rail corridor to an area. Future land use compatibility is based on information from general plans and other regional and local transportation planning documents. These documents were examined to assess an alignment option's potential consistency with the goals and objectives defined therein. The Rail Improvements Alternative is considered highly compatible if alignment options would be located in areas planned for transportation multi-modal centers or corridor development, redevelopment, economic revitalization, transit-oriented development, or high-intensity employment. Compatibility would be considered low if an alternative would be potentially inconsistent with local or regional planning documents. Table 3.6-1 summarizes the potential compatibility rating of existing and planned land use types with the alignment options. Thus, where potential compatibility would be rated low, the potential for impacts would be higher, and where potential compatibility would be rated high, the potential for impacts would be lower.

Table 3.6 1
Compatibility of Land Use Types

Compatibility		
Low	**Medium**	**High**
Single-family residential, neighborhood park, habitat conservation area, elementary/ middle school (widened or new right-of-way needed)	Multifamily residential, high schools, community parks, low-intensity industrial, hospitals	Business park/regional commercial, multifamily residential, existing or planned transit center, high intensity industrial park, service commercial, commercial recreation, college, transportation/utilities, high-intensity government facilities, airport or train station, agricultural (tunnel, covered trench, or no new right-of-way needed)

Communities and Neighborhoods

A potential impact on a community or neighborhood was identified if an alignment option would create a new physical barrier, isolating one part of an established community from another and potentially resulting in a physical disruption to community cohesion. Improvements to existing transportation corridors, including grade separations, would not generally result in new barriers.

Property

Assessment of potential property impacts is based on the types of land uses adjacent to the particular proposed alignment, the amount of right-of-way potentially needed due to the construction type, and the land use sensitivity to potential impacts. Impacts include potential acquisition, displacement and relocation of existing uses, or demolition of properties. Potential property impacts were ranked high, medium, or low as summarized below in Table 3.6 2.

Table 3.6 2
Rankings of Potential Property Impacts

Facility Requirements	Residential			Non-residential		
	Rural/ Suburban	Suburban/ Urban	Urban	Rural Developed	Suburban Industrial/ Commercial	Urban Business Parks/ Regional Commercial
No additional right-of-way needed (also applies to tunnel segments for Rail Improvements Alternative)	Low	Low	Low	Low	Low	Low
Widening of existing right-of-way required	Medium	Medium	High	Low	Medium	High
New corridor (new right-of-way required; includes aerial and at-grade improvements)	High	High	High	Medium	Medium	High

To determine potential property impacts, the land uses within 50 ft (15 m) of either side of the existing corridor, or within 50 ft (15 m) of either side of the centerline for new rail alignments, were characterized by type and density of development. Densities of structures, buildings, and other elements of the built environment are generally higher in urbanized areas. *Rural/suburban* residential refers to low-density, single-family homes. *Suburban/urban* is medium density, multifamily housing such as townhouses, duplexes, and mobile homes. *Urban* residential refers to high-density multifamily housing such as apartment buildings. *Rural developed* non-residential uses typically occur in non-urbanized areas. *Suburban industrial/commercial* refers to medium density non-residential uses and includes some industrial uses, as well as transportation, utilities, and communication facilities. *Urban business parks/regional commercial* refers to non-residential uses that occur in urbanized areas and includes such uses as business parks, regional commercial facilities, and other mixed use/built-up uses. The classification of development types was based on land use information provided by the planning agencies in the LOSSAN region.

Environmental Justice

This analysis is based on identifying the presence of minority populations and low-income populations in the study area (0.25 mi [0.40 km] from a potential alignment), and generally in the counties crossed by the alignment options. This assessment was done using U.S. Census 2000 information and alignment information to determine if minority or low-income populations exist within the study area and if they do, whether the alignments would be within or adjacent to an existing transportation right-of-way (lower potential for impacts) or new alignments (higher potential for impacts).

Based on the above information, the analysis determined the following.

- Whether at least 50% of the population in the study area may be minority or low-income.
- Whether the percentage of minority or low-income population in the study area may be at least 10% greater than the average generally in the county or community.

The assessment of potential for impacts on minority and low-income populations considered the size and type of right-of-way needed for the alternatives. For example, if an alignment were within an existing right-of-way, the potential for impacts would be lower. If the alignment would be on new right-of-way, then the potential for impacts may be higher. The potential alignments, however, have been identified to largely use or be adjacent to existing transportation rights-of-way in order to avoid or reduce potential impacts on natural resources and existing communities to the extent feasible and practicable (see Chapter 2, *Alternatives*). Since this is a program-level document, the analysis considers the Rail Improvements Alternative on a corridor-wide basis. It is not expected that the proposed Rail Improvements Alternative as a whole would result in disproportionate impacts on minority or low-income populations. Additional analysis would take place during project-level analysis to consider potential localized impacts.

3.6.2 Affected Environment

A. STUDY AREA DEFINED

The study area for land use compatibility, communities and neighborhoods, property, and environmental justice is 0.25 mi (0.40 km) on either side of the centerline of the rail alignment options included in the alternatives, and the same distance around stations. This is the extent of area where the Rail Improvements Alternative might result in changes to land use; the type, density, and patterns of development; and socioeconomic conditions. For the property impacts analysis the study area is narrower—100 ft (30 m) on either side of the alignment centerlines—to better represent the properties most likely to be impacted by the proposed rail alignment options.

The planned land uses for the region are generally described by city and county general plans that encompass the alignment options. Several regulatory agencies and special districts also have future development plans that are considered in this analysis for lands these alternatives would cross. Communities have typically recognized and incorporated the existing LOSSAN rail corridor in their general land use plans, and most communities encourage transit-oriented development and transit facilities to relieve highway congestion and improve mobility.

Other resources such as U.S. Census 2000 data, aerial photos, and field observations were used to document existing and future (Year 2020) conditions for demographics, communities, and neighborhoods.

B. LAND USE-RELATED RESOURCES IN THE STUDY AREA

Figure 3.6-1 shows the general land uses existing along the LOSSAN corridor. For this discussion, land use data came from local governments and regional agencies such as metropolitan planning organizations. The source of demographic information (existing population and projects, ethnicity, income, and housing) was primarily U.S. Census

2000. These data, as well as existing and planned land use information, were compiled in a GIS format.

Existing Land Use

The existing LOSSAN rail corridor traverses a variety of existing land uses, the majority of which are single-family residential, community parks, and low-intensity industrial uses. The area of potential impact is considered to be a 0.25-mi (0.40 km) buffer on each side of the segments of the rail line in which improvements are being considered. The LOSSAN region is largely urbanized, with the exception of the U.S. Marine Corps Base at Camp Pendleton between San Clemente and Oceanside. Between San Juan Capistrano and Del Mar, the existing train tracks run along beaches and through coastal communities.

Existing land uses and public facilities within the 0.25-mi (0.4 km) study area are summarized in Table 3.6-3. There are some agricultural lands within the study area, between Santa Ana and Irvine and near Oceanside, which include prime farmlands and farmlands of local importance. However, in these areas, proposed rail improvements would occur within the existing LOSSAN rail corridor right-of-way, so no agricultural lands would be affected. Therefore, agricultural lands are not addressed further in this document. The location of local law enforcement and emergency service facilities were not identified at this program level.

Table 3.6-3
LOSSAN Existing Land Uses

Land Use within Study Area	Acres	Percent of Study Area
Single Family Residential	7,461	27%
Community Parks	4,639	17%
Low-intensity Industrial	3,715	14%
Transportation/Utilities	2,969	11%
High Intensity Industrial Park	1,958	7%
Commercial Recreation	1,738	6%
Business Park/Regional Commercial	1,027	4%
Agriculture	785	3%
Multi-family Residential	645	2%
College	600	2%
Neighborhood Park	597	2%
High Intensity Government Facilities	587	2%
High Schools	346	1%
Service Commercial	151	<1%
Hospitals	47	<1%
Elementary/Middle School	35	<1%
Total	**27,301**	**100%**

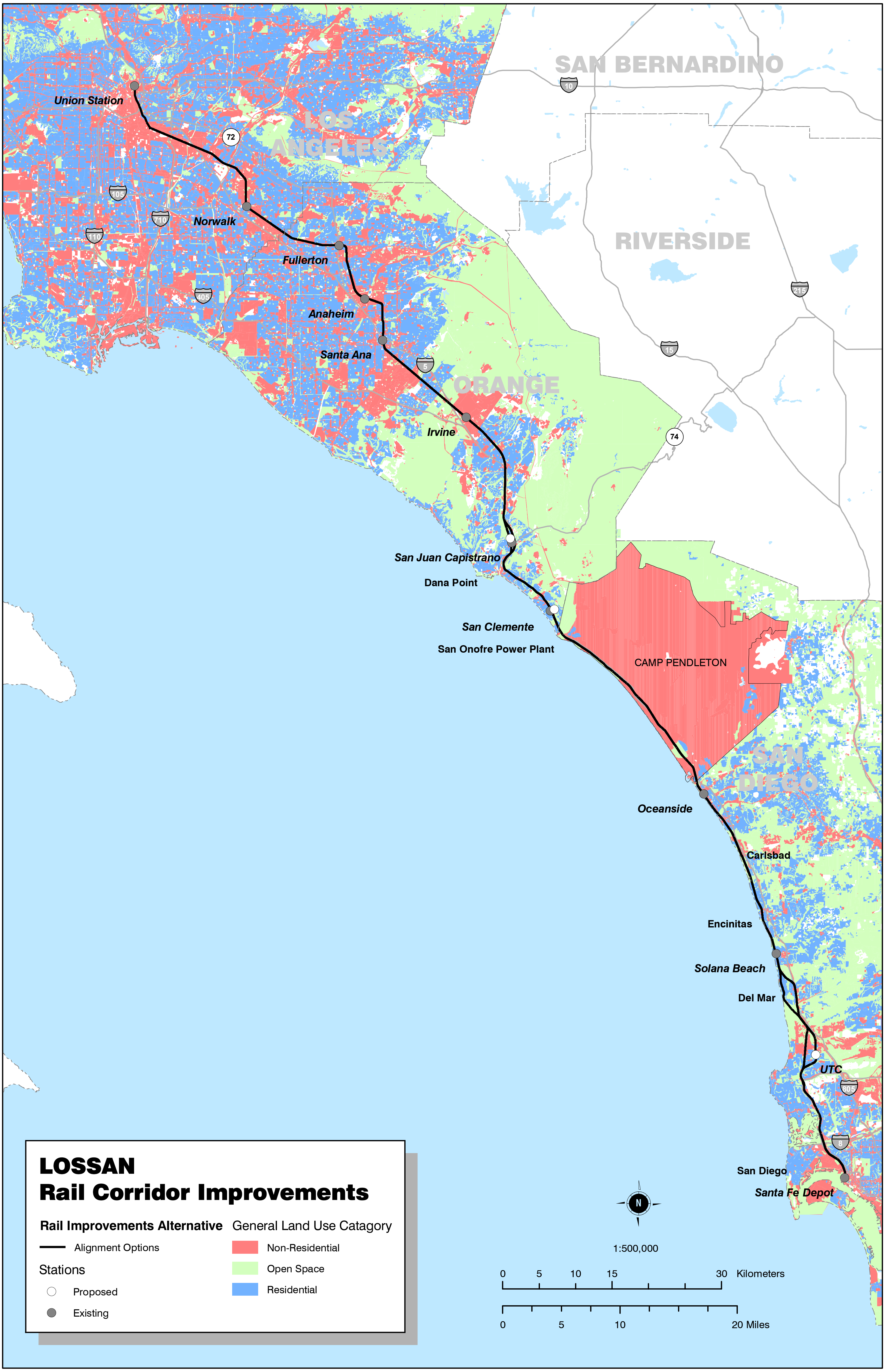


FIGURE 3.6-1

Generalized Existing Land Uses

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

Population Characteristics

The LOSSAN region includes three counties: Los Angeles, Orange, and San Diego. The region's population increased by 10% between 1990 and 2000, from 13.8 million persons to 15.2 million. By 2020, population in this region is forecast to reach 18.6 million, an increase of 23% (Southern California Association of Governments [SCAG] 2001; San Diego Association of Governments [SANDAG] 2002).

Minority persons accounted for 51% of Los Angeles County in 2000, 35% of Orange County, and 34% of San Diego County. The Hispanic population is 45% in Los Angeles County, 31% in Orange County, and 27% in San Diego County.

Income

According to 2000 Census data, the study area of the alignment options and expanded or new stations pass through a total of 332 Block Groups with a total population of 1,124,297 and 336,305 households. Of these, 36,060 households (11%) are living below the federal poverty level of $17,603 annual income. In Los Angeles County per-capita income was $20,683, with 18% of the population below the federal poverty level. Per-capita income in Orange County was $25,826, with 10% of the population below the federal poverty level. San Diego County had a per-capita income of $22,926, with 12% of the population below the federal poverty level.

Neighborhood and Community Characteristics

The proposed Rail Improvements Alternative alignment options would pass through communities in the metropolitan area of Los Angeles, south Orange County, and the metropolitan area of San Diego. Communities in these areas have both common and unique characteristics shaped by a variety of political, physical, social, and economic factors. The Los Angeles metropolitan area can be characterized as a highly urbanized mix of single- and multifamily neighborhoods, with commercial and industrial development in such communities as Los Angeles, Norwalk, Fullerton, and Anaheim. The area is strongly influenced by the existing transportation network. The south Orange County area is characterized by smaller communities with strong ties to the coastline. The communities comprise largely single-family neighborhoods with supporting commercial and industrial development. Communities such as San Juan Capistrano, Dana Point, and San Clemente represent this area. The San Diego metropolitan area can be characterized as a highly dense urban area rimmed by lower density suburban and coastal communities that have close interaction with coastal resources. Communities that represent this area are Oceanside, Carlsbad, Encinitas, Solana Beach, and Del Mar.

3.6.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

Land use and local communities will change between 2003 and 2020 as a result of population growth and changes of economic activity in the LOSSAN region. The No Project Alternative is based on existing conditions and the funded and programmed transportation improvements that will be developed and in operation by 2020. Although it is expected that the No Project Alternative would result in some changes related to land use compatibility, communities and neighborhoods, property acquisitions and relocations, and environmental justice, it was assumed that projects included in the No Project Alternative would include typical design and construction practices to avoid or minimize potential impacts, and would be subject to a project-level environmental review process to identify potentially significant impacts and to include feasible mitigation measures to avoid or substantially reduce potential impacts. Although some changes would be likely, attempting to estimate such changes would be speculative. Therefore, no additional potentially significant impacts were quantified for the No Project Alternative.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Potential land use impacts and key differences among alignment options are described below. Short-term, direct land use impacts (during construction) could include road closures and traffic detours, disruption of access to public facilities and emergency services, and physical barriers to communities and business districts. Barriers or access disruptions could require alteration or temporary relocation of public facilities or emergency service providers. Potential long-term impacts include the creation of new or exacerbation of existing physical barriers to neighborhoods and business districts; property acquisition and residential or commercial relocation, and the introduction of new transportation corridors in residential areas. Improvements in access or removal of existing barriers would be long-term, beneficial impacts.

All of the alignments would be compatible with existing local land use plans. Some alignment options would require property acquisition, and some would exacerbate an existing barrier effect of the rail corridor on communities. Other options would reduce the existing land use impacts of the LOSSAN rail corridor by removing existing tracks into trenches or tunnels, or providing grade separations or pedestrian crossings where none currently exist.

Land Use Compatibility and Property Impacts

Overall, the proposed Rail Improvements Alternative would be highly compatible with local and regional plans that support rail systems and transit-oriented development. Because nearly all alignment options are within or adjacent to existing transportation rights-of-way, the Rail Improvements Alternative generally would have a low potential for new land use-related impacts. Some of the alignment options would have a beneficial effect, compared to the No Project Alternative, by reducing or eliminating existing land use impacts along the LOSSAN rail corridor. The Rail Improvements Alternative would also provide improved inter-modal connectivity with existing local and commuter transit systems.

Potential property impacts would be relatively low for much of the Rail Improvements Alternative because most alignment options would either be accommodated within the existing right-of-way of the LOSSAN rail corridor, or would involve deep tunnels that would avoid property impacts. In most areas, commercial and industrial uses are located along the rail corridor, and these uses buffer residential development from the railroad. However, potentially high impacts would occur in the few areas where new right-of-way would be needed or the existing right-of-way would be widened (described below). It is estimated that a total of 50 or fewer residential units could be affected by the Rail Improvements Alternative, and between 25 and 45 ac (10 and 18 ha) of non-residential property could be affected, depending on the alignment option.

The specific locations of public facilities and emergency services (such as schools, parks, fire and police stations, hospitals and medical clinics) were not identified for this program-level assessment. However, construction of various alignment options under the Rail Improvements Alternative would be expected to create some temporary access disruptions and create some barriers to access to and from public facilities, and cause an impediment to emergency response times in the vicinity of construction. It is also expected that the Rail Improvements Alternative would have some long-term, beneficial effects on access to public facilities and on emergency response times, particularly in areas where the rail corridor would be grade separated. These potential impacts would be examined in detail at the project level.

Land use compatibility and potential property impacts are described below by corridor segment.

<u>Union Station to Irvine</u>: Between Union Station and Fullerton, the proposed fourth main track would be accommodated within the LOSSAN rail right-of-way for the majority of this alignment and, therefore, would be compatible with existing and planned land uses. However, there are segments that may require property acquisition due to limited right-of-way width, particularly between the Rio Hondo River and San Gabriel River. Residential and commercial uses adjacent to the corridor would likely be impacted. Based on program-level evaluation, it is estimated that property impacts could affect approximately 25 to 30 multi-family residential units (apartments) and up to 1 ac (0.4 ha) of commercial and industrial property.

Rail improvements proposed between Fullerton and Irvine include a covered trench option or an at-grade option between Walnut Avenue, in the City of Orange, and 17th Street, in the City of Santa Ana, and a curve realignment between Batavia Street and Walnut Ave. Up to 1 ac (0.4 ha) of commercial property acquisition could be required along the curve realignment. The covered trench and at-grade options would occur within the existing rail corridor right-of-way, and would be compatible with existing and planned land uses. The trench option would reduce existing impacts of the at-grade LOSSAN rail alignment to residential land uses that have developed adjacent to the rail corridor. The at-grade double-tracking option would exacerbate the existing rail impacts to these residential areas; however, this option would include grade separations at street intersections which would improve existing pedestrian and vehicular access to businesses and residences in the area.

Proposed improvements at existing rail stations between Union Station and Irvine would consist of additional parking at the Fullerton, Anaheim, Santa Ana, and Irvine stations. These improvements would be compatible with existing and planned land uses in these existing station areas.

<u>San Juan Capistrano</u>: The existing LOSSAN rail corridor runs through downtown of San Juan Capistrano through the historic Los Rios neighborhood. The existing rail station is listed in the City's Inventory of Historical and Cultural Landmarks (IHCL). There is an ordinance in place that provides special protection to this and other cultural resources identified in the IHCL. Based on high potential land use impacts and input from the public and City officials, double-tracking through the downtown area within the existing

rail alignment was eliminated from further consideration during the LOSSAN screening process (refer to Chapter 2, *Alternatives*). Two alternative alignments are being evaluated in addition to the No Project alternative.

One alignment option through the City of San Juan Capistrano runs along the east side of Trabuco Creek. This alignment would leave the existing LOSSAN corridor south of Del Obisbo and continue at-grade along the east side of Trabuco Creek, then transition into a cut-and-cover and open trench to a new, below-grade station site located south of Ramos Street. This site is currently being used as recreational vehicle storage, and would require up to 2 ac (0.8 ha) of non-residential property acquisition. The alignment would transition back to at-grade north of the station and rejoin the existing rail corridor at the Trabuco Creek crossing. The bridge structure over Trabuco Creek would be rebuilt to accommodate the alignment. Strategically placed pedestrian crossings over Trabuco Creek would help connect the activities on either side.

This alignment would introduce rail into a new corridor. Residential uses exist along the western boundary of Trabuco Creek, and office/commercial development and a private high school are located along the eastern boundary of the creek. This alignment would have noise, visual, and possibly vibration impacts on the existing land uses west and east of the proposed alignment, particularly on residential areas to the west. Up to 11 ac (4.4 ha) of non-residential property acquisition would be required, probably involving the high school property at the northern end of the alignment and some commercial property at the southern end. A benefit of this alignment is that it would remove the existing rail impacts on the historic neighborhood of Los Rios and downtown historic structures. It would also remove the major pedestrian barrier created by the existing rail tracks between the downtown area and the historic residential area.

Another routing option evaluated in San Juan Capistrano is a tunnel alignment along Interstate 5 that would run the length of the city. While most of the tunnel would be under Interstate 5, there would be transition areas at either end of the tunnel that would likely require up to 6 ac (2.4 ha) of non-residential property and/or easement acquisition. While this option would be compatible with existing and planned land uses, it would eliminate a rail station in the City of San Juan Capistrano.

<u>Dana Point/San Clemente</u>: The existing LOSSAN rail corridor is located along the coast in Dana Point and San Clemente, and runs adjacent to residences in the northern part of San Clemente along North El Camino Real. Two tunnel alignments are being evaluated in the Dana Point and San Clemente area, a short tunnel and a long tunnel option. Either option would follow Interstate 5 and have a southern endpoint at San Onofre State Beach, north of the power plant.

The short tunnel would leave the Interstate 5 corridor at Avenida Palizada, turn toward the coast and run underneath residential, industrial and vacant land uses, connecting with the existing rail corridor just south of Camino Capistrano. A new station would be located at Avenida Pico. The new station location is consistent with the future land use plan, which promotes the development of a major mixed-use development, Rancho San Clemente Town Center, in the vicinity. The station site would require up to 2 ac (0.8 ha) of non-residential property acquisition.

The tunnel portion of this option would be compatible with existing and future land uses, due to the depth of the tunnel. However, this option would also involve straightening the existing at-grade Dana Point curve alignment. The curve realignment would begin just north of Stonehill Drive and would cut through a 31-ac (12.5 ha) site owned by the South Coast Water District (SCWD). This site contains a number of major water and sewer transmission lines, a well, a wastewater lift station and maintenance area, a variety of leasehold tenants including contractor storage yards and landscape nurseries, and unimproved land. The site is largely surrounded by urban industrial development. An EIR certified by the SCWD in November of 2002 identifies three land use alternatives for the site, any of which would be impacted by the rail realignment. The proposed rail re-alignment would be compatible with the City of Dana Point General Plan but would be incompatible with planned land uses on the SCWD site and inconsistent with the certified EIR. Up to 13 ac (5.3 ha) of non-residential property acquisition could be required for the at-grade and tunnel portal areas of the short-tunnel option. The alignment could also require water and sewer infrastructure relocation on the SCWD property.

The other alignment option being evaluated is a long tunnel that would follow Interstate 5 from San Onofre State Beach to Avenida Aeropuerto in San Juan Capistrano. This option would preclude the need for realigning the Dana Point Curve. Under this option, the tunnel would be divided into two segments, with the rail daylighting at Avenida Pico where a new station would be located. The station site would be consistent with the future land use plan, which advocates a major regional commercial center at the southwest corner of Interstate 5 and Avenida Pico. Acquisition of up to 6 ac (2.4 ha) of industrial business property would likely be required at the tunnel portal area south of Avenida Aeropuerto. The long tunnel option would be compatible with existing and planned land uses, and would provide an opportunity to remove the existing track along the coastline, thereby eliminating existing impacts to residential development and removing the barrier to recreational use of the coastline.

<u>Camp Pendleton</u>: The Rail Improvements Alternative would involve at-grade double-tracking within the existing LOSSAN corridor from the San Onofre Power Plant to north of Oceanside, across Camp Pendleton. All but approximately 5.5 mi (8.9 km) of this 16-mi (26-km) rail segment are double-tracked under the No Project Alternative. The completion of double-tracking in this segment would be compatible with existing and planned land uses, and would remain within the existing rail right-of-way.

<u>Oceanside/Carlsbad</u>: An at-grade and a trench option within the LOSSAN rail right-of-way are being evaluated for double tracking through Carlsbad. Existing land uses abutting the LOSSAN corridor include residential, commercial and industrial. Although the at-grade option would be compatible with existing and planned land uses, it would compound the barrier effect of the existing rail corridor. The trench option would reduce some of the rail impacts on adjacent land uses, and would provide for grade separations at key intersections through downtown, resulting in improved pedestrian and vehicular circulation.

Proposed improvements to the existing Oceanside Station would include by-pass tracks and expanded parking. The surrounding land use is a mix of commercial and residential. The improvements would be compatible with existing and planned land use. Any parking expansion would likely involve up to 1 ac (0.4 ha) of commercial property acquisition.

Encinitas: Two double-tracking options were evaluated for the LOSSAN corridor through the City of Encinitas – at-grade, and a short trench. Residential, commercial, and industrial land uses are adjacent to the rail corridor and the corridor acts as a barrier to pedestrian and vehicular movement between residential and commercial areas on opposite sides of the LOSSAN right-of-way.

The at-grade option would reconfigure the street intersection at Birmingham Drive and San Elijo Avenue, and close Chesterfield Drive at San Elijo Avenue. This proposal would involve a short trench segment for the rail corridor, on either side of Birmingham Drive, providing improved pedestrian and vehicular circulation across the existing rail corridor via Birmingham Drive. The Coast Highway 101 would need to be elevated about 20 ft (6 m) in this area to intercept Birmingham Drive. This would impact adjacent commercial and residential land uses. Another grade separation would occur at Leucadia Boulevard. The rail tracks would be depressed with Leucadia Boulevard going over the tracks and Coast Highway 101. This would require acquisition of some businesses along the highway. Pedestrian undercrossings would be strategically placed along the entire route to reduce the physical barrier created by the existing rail corridor.

The short trench alternative would be similar to the at-grade alternative, except for a covered trench under Encinitas Boulevard and a transitional open trench about 1,500 ft (457 m) either side of Encinitas Boulevard. This trench would improve pedestrian and vehicular circulation through the downtown area.

Both options would be compatible with existing and planned land uses along the existing rail corridor. A total of up to about 2 ac (0.8 ha) of non-residential property would likely be acquired for implementation of either the at-grade or short-trench option through Encinitas.

Proposed improvements at the Solana Beach Station would include platform modifications and parking expansion. These improvements would be compatible with the existing and future land use for this area.

Del Mar: Two alignment options for double-tracking are being evaluated through the City of Del Mar, between the Solana Beach Station and the I-5/805 split. Land uses along the existing rail corridor include the Del Mar Fairgrounds and San Dieguito Lagoon on the north, Los Penasquitos Lagoon on the south, and residential and commercial development through most of Del Mar.

One option is a tunnel underneath Camino Del Mar. The tunnel would begin at Jimmy Durante Boulevard, and improvements would involve a grade separation of the rail and road system in this area. Either Jimmy Durante Boulevard or Camino Del Mar would be redesigned to cross over the tracks and "T" into the other. This would require up to 2 ac (0.8 ha) of non-residential property acquisition. The tunnel would daylight at Carmel Valley Road and connect with the existing LOSSAN corridor across Los Penasquitos Lagoon. This option would remove the existing track from the coastal bluffs and separate the rail from low-density residential land use. This alternative would be compatible with existing and planned land use.

The other option is a tunnel that would run under I-5. This option would diverge from the LOSSAN corridor near the Del Mar Fairgrounds, cross along the south boundary of San Dieguito Lagoon on an elevated structure, and then proceed in a tunnel under I-5 to a point approximately midway along the existing alignment through Penasquitos Lagoon where it would rejoin the existing rail corridor. Like the other tunnel option, this alignment would provide the benefit of removing the rail from the bluffs. The I-5 tunnel option would be incompatible with existing single-family residential development at the tunnel portals and along the southern edge of San Dieguito Lagoon where the rail structure would be elevated. The I-5 tunnel option would require acquisition of approximately 15 to 20 residential units, and up to 8 ac (3.2ha) of non-residential property.

<u>I-5/805 Split to Highway 52</u>: In this section of the LOSSAN Corridor, two tunnel alignments are being evaluated. One tunnel would run under Interstate 5 and the other would cut through Miramar Hill. The Miramar Hill tunnel option would run under mixed land uses and include a new underground station at University Towne Centre. Either tunnel would be at a depth where impacts to residential and commercial development would be avoided except at tunnel portals. The I-5 tunnel could require up to 1 ac (0.4 ha) of non-residential property acquisition at portal areas. Both tunnel options would be compatible with existing and planned land use. The Miramar Hill tunnel would have the added benefit of providing a rail station near a highly populated employment center.

<u>Highway 52 to San Diego Santa Fe Depot</u>: Proposed improvements for the LOSSAN Corridor between Highway 52 and the Santa Fe Depot include a curve realignment just south of Highway 52, new bridges over Tecolote Creek and San Diego River, a trench between Sassafras Street and Cedar Street, and double tracking for the length of the section. The curve realignment would involve two new bridge structures over wetlands in San Clemente Canyon and potential property acquisition of a business. Existing land uses along the route are a mix of industrial and commercial. The improvements would enhance vehicular circulation and reduce impacts to businesses adjacent to the trench segment, by depressing the existing rail corridor. These improvements would be compatible with existing and planned land use.

At the Santa Fe Depot, parking would be expanded at the northwest corner of Broadway and Pacific Coast Highway. The surrounding land uses are commercial and industrial. The proposed expansion would be compatible with existing and planned land use.

<u>Communities and Neighborhoods</u>

Potential impacts to communities and neighborhoods were assessed on the basis of whether or not an alignment option would divide an existing residential neighborhood where no division exists under current conditions. Nearly all alignment options evaluated under the Rail Improvements Alternative are within or adjacent to existing transportation corridors (rail or roadway) and many involve deep tunnels, reducing the potential for creating new divisions of existing communities.

There are locations where the existing rail tracks divide residential communities that have developed around the rail corridor, as described above under *Land Use Compatibility*. Some improvement options would add a second track within the rail right-of-way in these areas (e.g., the at-grade options between Fullerton and Irvine, and in Carlsbad). Double-tracking may exacerbate the existing barrier effect in these areas, but no new barrier would be created and, therefore, no substantive impact to communities or neighborhoods would occur beyond those that exist under the No Project Alternative.

In other areas, some alignment options would reduce the existing barrier effect of the LOSSAN rail corridor. For example, in Encinitas, the at-grade improvement option would add pedestrian crossings to alleviate existing impacts of the rail corridor. Other options would involve tunnels or covered trenches where existing tracks would be removed and placed underground, either within the LOSSAN corridor alignment (e.g., trench option in Encinitas) or within another transportation corridor (e.g., the Camino del Mar tunnel option through Del Mar). In these cases, any existing barrier effect of the rail would also be reduced or eliminated entirely, resulting in an improvement compared to the No Project Alternative.

There are two areas where alignment options would introduce an above-ground rail corridor into residential areas where there currently is no rail corridor. The Trabuco Creek at-grade and trench option in San Juan Capistrano would add rail in a new area; however, the creek itself creates a barrier in this area, so the rail would not add a new barrier. Similarly, the northern end of the I-5 tunnel in the Del Mar area would add rail infrastructure near residences at the south end of the San Dieguito Lagoon. In this area, however, the rail structure would be elevated along the edge of a residential area and so would not divide an existing community.

Environmental Justice

Nearly all of the alignment options evaluated under the Rail Improvements Alternative would be located within or adjacent to existing transportation corridors, which would serve to reduce the potential for significant adverse impacts generally. Considering the Rail Improvements Alternative overall, it is not expected that the alternative would result in disproportionate impacts on minority populations or low-income populations.

If the Rail Improvements Alternative were carried forward for further evaluation, project-level review would include more detailed analysis, including additional consideration of the potential for disproportionate localized impacts on Environmental Justice communities, as well as potential community enhancements and benefits. Based on program-level data, areas of potential localized concern occur between Union Station and Irvine, and in the San Juan Capistrano area.

3.6.4 Mitigation Strategies

The analysis in this Program EIR/EIS compares potential impacts from the alternatives and the Rail Improvements Alternative alignments and station options. Potential impacts have been considered on a broad scale and on a corridor-wide basis. If a decision is made in the future to proceed with the proposed Rail Improvements Alternative, project-level review would analyze the potential for localized impacts.

A. LAND USE COMPATIBILITY

Local land use plans and ordinances would be further considered in the selection of alignment options. Project-level review would consider consistency with existing and planned land use, neighborhood access needs, and multi-modal connectivity opportunities.

B. COMMUNITIES AND NEIGHBORHOODS

If selected, the proposed Rail Improvements Alternative alignments would be refined in consultation with local governments and planning agencies, with consideration given to minimizing barrier effects to maintain or improve existing neighborhood integrity. Potential mitigation strategies to reduce the effects of any existing or exacerbated barrier effects would be considered at the project-level environmental review and could include additional grade separation of rail lines and streets, new pedestrian crossings, new cross-connection points, improved visual quality of project facilities, and traffic management plans to maintain access during and after construction.

C. PROPERTY

Potential land use displacement and property acquisition (temporary use and/or permanent, residential and non-residential property) are expected to be avoided to the extent feasible by considering further alignment adjustments and design changes in the future at the project level. In addition, analysis at the project level would consider relocation assistance in accordance with the Federal Uniform Relocation and Real Property Acquisition Policies Act of 1970.

D. ENVIRONMENTAL JUSTICE

On a corridor basis, it is not expected that the proposed Rail Improvements Alternative would result in disproportionate adverse effects to minority or low-income populations. If a decision is made to pursue the development of the Rail Improvements Alternative, additional consideration of environmental justice issues would occur during project-level review, which would include consideration of potential disproportionate localized impacts and potential benefits to and enhancements for communities along potential rail alignments. Project-level review would include consideration of detailed mitigation measures, including mitigation for temporary construction-related impacts. Project-level review would also include outreach to potentially affected communities as part of the public review process.

3.6.5 Subsequent Analysis

Should the Rail Improvements Alternative be selected, the subsequent environmental evaluations and project-level review of proposed alignment options and new or expanded stations would address the need for the following studies.

- Land use studies for specific alignment and station areas potentially impacted, including evaluation of potential land use conversion, potential growth, and potential community benefits.
- Review of localized potential environmental justice issues.
- Relocation impact analysis for potentially displaced housing and businesses.
- Pedestrian and vehicular circulation studies.

3.7 AESTHETICS AND VISUAL RESOURCES

Visual resources are the natural and human-made features of a landscape that characterize its form, line, texture, and color. This section describes the existing landscape in the LOSSAN region and identifies potential impacts on visual resources related to the proposed addition of infrastructure in, or removal of infrastructure from, the existing landscape. Infrastructure may include rail tracks, tunnels, fences, noise walls, elevated rail structures, and stations. This assessment evaluates the potential changes to existing scenic landscapes for each alignment and station option during construction (addition of construction staging areas, site work, construction equipment, temporary barriers, fences, and temporary power poles) and operation.

3.7.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY PROVISIONS

There are no specific regulatory requirements or federal or state standards for aesthetics and visual resources. However, there is a requirement in both federal and state environmental guidelines to address topics related to the visual environment. The most explicit guidance is in the CEQA environmental checklist, which requires that a project proponent identify whether a project would have a substantial adverse effect on a scenic vista; substantially damage scenic resources, including trees, rock outcroppings, and historic buildings within a state scenic highway; substantially degrade the existing visual character or quality of the site and its surroundings; or create a new source of substantial light or glare that would adversely affect day or nighttime views in the area (CEQA Appendix G Environmental Checklist Form, 2001). The FRA Procedures for Considering Environmental Impacts (FRA Docket No EP-1, Notice 5, May 26, 1999), under the topic of aesthetic environmental and scenic resources, states: "The EIS should identify any significant changes likely to occur in the natural landscape and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by DOT Order 5610.4." Consideration of local community design guidelines would be part of a subsequent phase of analysis for project-specific environmental review when more detailed engineering and architectural information would be developed if the Rail Improvements Alternative is carried forward. California Department of Transportation design standards would apply to state highway improvements under the No Project Alternative.

B. METHOD FOR EVALUATION OF IMPACTS

The analysis of aesthetic and visual resources for this Program EIR/EIS focuses on a broad comparison of potential impacts on visual resources (particularly scenic resources, areas of historic interest, and natural open space areas and significant ecological areas) along proposed Rail Improvements Alternative alignment options and around stations. The potential impacts for each of these alternatives are evaluated against the existing conditions, as described in Section 3.7.2, *Affected Environment*.

Based on conceptual design, the facilities associated with the Rail Improvements Alternative were evaluated for a set of typologies (or general descriptions) representative of highly scenic landscapes most subject to potential significant visual impacts. The evaluation focused on how the distinguishable (dominant) visual features (color, line, texture, form) that characterize the existing landscape would change if the alignment option were implemented. Of particular interest are locations where options would involve elevated structures (bridges or overpasses) or tunnel portals. Also addressed in the evaluation is the potential shadow effect of elevated structures and the light and glare effects of the proposed improvements.

Potential changes to the dominant landscape features, or potential visual impacts, are described and ranked as high, medium, or low according to the potential extent of change to existing visual resources. Visual contrast rankings, or impact rankings, are defined as follows.

- *High visual impacts* would be sustained if features of the alternative were obvious and began to dominate the landscape and detract from the existing landscape characteristics or scenic qualities.
- *Medium visual impacts* would be sustained if features of the alternative were readily discernable but did not dominate the landscape or detract from existing dominant features.
- *Low visual impacts* would be sustained if features of the alternative were consistent with the existing line, form, texture, and color of other elements in the landscape and did not stand out.
- *High shadow impacts* would occur if a new (not existing) elevated structure were within 75 ft (23 m) of residential or open space, natural areas, or parkland.
- *Beneficial visual impact* would result if the alternative eliminated a dominant feature in the landscape that currently detracts from scenic qualities or blocks vistas.

3.7.2 Affected Environment

A. STUDY AREA DEFINED

The study area for aesthetics and visual resources is defined as 0.25 mi (0.40 km) from the centerline of proposed alignment options and around stations. However, where there are scenic viewing points or overlooks within 1 mi (2 km) of the alignment option, these scenic viewing points have been included in the study area. The distance range of up to 0.25 mi (0.40 km) from proposed alignments and stations and up to 1 mi (2 km) for scenic viewing points is considered the area where a change in landscape features would be most noticeable to viewers, and where newly introduced features could begin to dominate the visual character of the landscape.

B. AESTHETICS AND VISUAL RESOURCES IN THE STUDY AREA

The existing local visual setting in the LOSSAN region ranges from highly urbanized landscapes to undeveloped areas. Much of the existing rail and highway system in the southern part of the region parallels the coastline of the Pacific Ocean. The existing LOSSAN rail corridor provides passengers with scenic views of the ocean and open spaces along portions of its route.

There are no local- or state-designated scenic corridors in the study area for visual resources in this region, though some highways (e.g., SR-1 along the coast) are considered eligible for designation as California State Scenic Routes and are located near the existing rail corridor. These routes do not offer continuous views of the ocean within the study area.

The LOSSAN region includes a number of distinct types of landscapes spread over a large geographic area. A typology of typical landscapes is used to describe the aesthetic and visual resources in the study area. The typologies provide the baseline or existing conditions against which the analysis of potential change or visual impact for each of the rail improvement option is evaluated. Photographs of highly scenic and typical landscapes within the LOSSAN region are provided to illustrate the dominant line, form, color, and texture for that landscape typology.

The landscape typologies discussed below are urban mixed use, suburban and coastal communities, and parks and natural open space.

Urban Mixed Use

The majority of the existing rail corridor traverses through dense development that includes warehouses, commercial and industrial buildings, and residential housing (areas in Los Angeles County and northern/central Orange County, for example). The industrial uses often are located along the railroad right-of-way, so the rail corridor is visible only from the streets that intersect it and parallel it as a frontage road. Limited landscaping and native vegetation exist in these industrial areas that are dominated by the typically large, box buildings. There are areas of high-density housing (multi-family and single-family dwelling units) in the foreground along the railroad right-of-way, most of which are typical, rectangular building shapes and regular lot patterns. Residential, commercial and industrial building structures blend with the surrounding environment with neutral colors, tones and textures. Rooftops and some mountains can be seen in the background along the rail corridor. Historic structures such as Mission San Juan Capistrano and the Los Rios District (also in San Juan Capistrano), and more modern developments such as downtown Los Angeles or San Diego are examples of various urban settings. The historic areas typically include older structures, often with architectural importance that varies in texture, size, and color.

Urban areas include a number of potential redevelopment sites. Underused areas subject to redevelopment often consist of abandoned buildings, pavement, industrial infrastructure, and junkyards. While these areas often served important military or industrial activities in the past, they are usually not visually compatible with the surrounding area. Reuse plans for such locations typically are prepared by local jurisdictions, and may improve the visual quality of the area. Parts of the downtown areas in Los Angeles and San Diego are examples of redevelopment areas in the urban setting.

Suburban and Costal Communities

There are a number of suburban communities in the region that are located close to commuter and transportation hubs, and surrounded by retail, business and residential land uses. The neighborhoods are moderately dense with more vegetation and landscaping than the residential areas found in the urban environment. Business locations and building structures are smaller and less dense with softer textures, color and tones than the urban environment. The city center and neighborhoods in these communities are separated by transportation corridors and/or undeveloped land.

Examples include Santa Ana, Carlsbad, and Encinitas. Figure 3.7-1 shows the existing at-grade LOSSAN corridor within the City of Carlsbad.

In the area from Dana Point south to San Diego, many of the suburbs are coastal communities where the ocean and local beaches influence (and often dominate) the visual setting of the area. Ocean views in these areas are open and highly scenic. The topography varies from flat shorelines to vertical cliffs. Views from many homes and businesses are dramatic, and the buildings are situated to take full advantage of these views. Residences and small businesses in coastal communities are typically landscaped to blend in with the surrounding environment. Areas within the coastal communities may include small pockets of open space. Examples of coastal communities include San Clemente, Cardiff, Del Mar, and Solana Beach.

Figure 3.7-2 shows the beachfront alignment of the existing LOSSAN rail tracks at the base of the coastal bluffs in San Clemente. The view shown is to the north from an existing pedestrian footbridge located just south of the pier. The strong horizontal line of the rail corridor interlocks and contrasts with the strong vertical line of the bluffs. Residences along the bluff tops provide highly scenic, distant views of the shoreline and ocean. In Del Mar, the rail corridor is on top of a narrow portion of the coastal bluffs. As shown in Figure 3.7-3, the existing tracks are set between the shoreline below and the residences above.

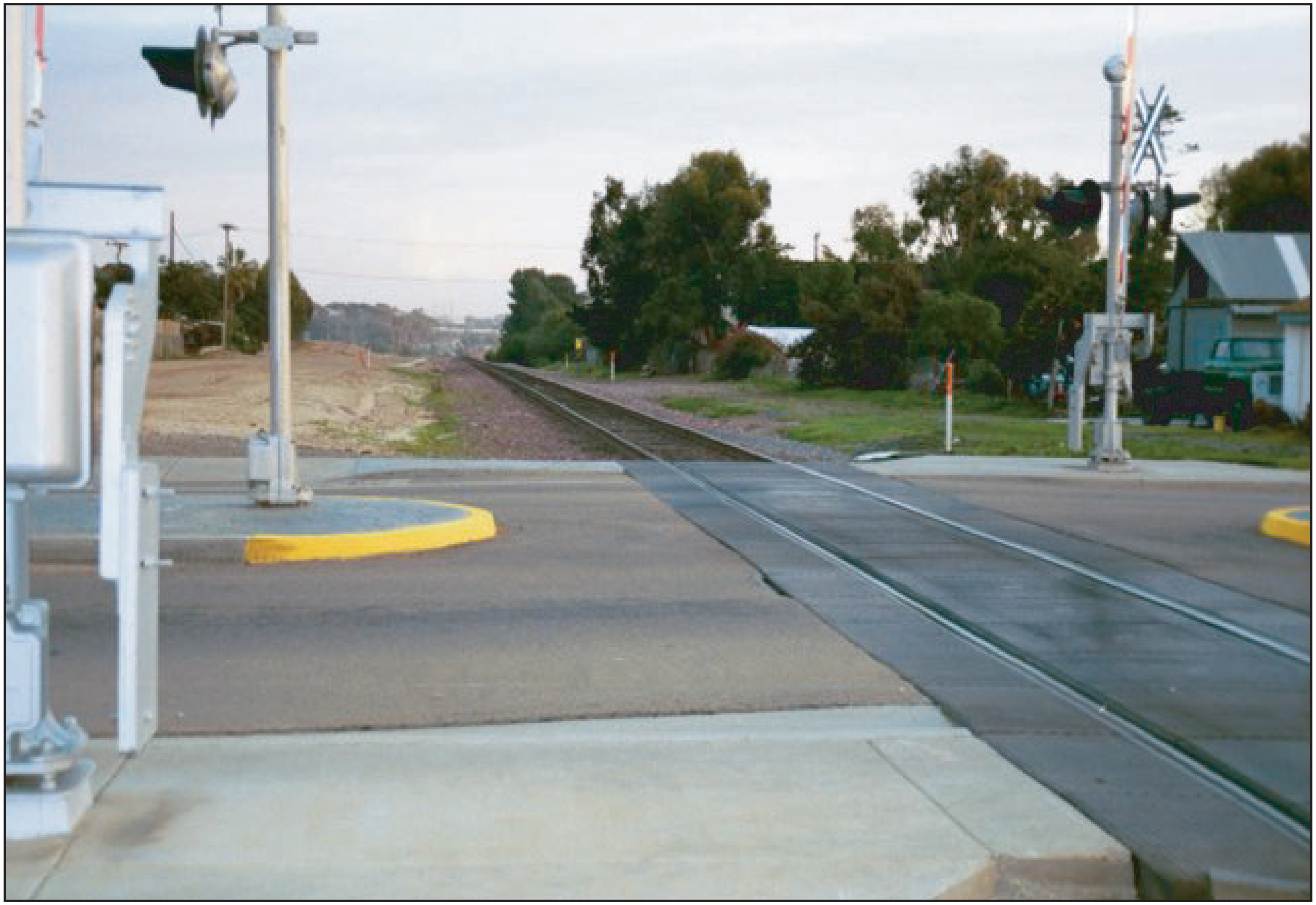
Parks and Natural Open Space

Parks and open space in the region typically are high points with a dramatic backdrop to various settings such as urban areas, historical districts, parks, and wildlife preserves. Calafia Park (in San Clemente), Camp Pendleton, area beaches, and a number of lagoons are examples of parks and open space areas along the existing LOSSAN rail corridor. The Camp Pendleton area is undeveloped land with some large overhead transmission lines, some industrial facilities (e.g., San Onofre Power Plant), and the I-5 corridor. The beach areas and lagoons include residential and some small commercial buildings. These are usually landscaped to blend with the surrounding environment and are often found in small clusters. Figure 3.7-4 illustrates an example of open space in the region and shows the existing railroad bridge across the San Elijo Lagoon.

3.7.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The existing conditions in 2003, or existing landscapes, are used as the baseline and are considered to be representative for the analysis of potential visual impacts for the Rail Improvements Alternative. Though it is likely that the existing landscape character will change in the region by the year 2020 due to development and urban growth, it is not possible to characterize these changes at this time with precision. To base comparisons of alternatives on current conditions is to take a conservative approach. The extent of change to some of the landscapes (particularly the open space landscapes) reported in this section may not be as pronounced as they appear in this impact evaluation.



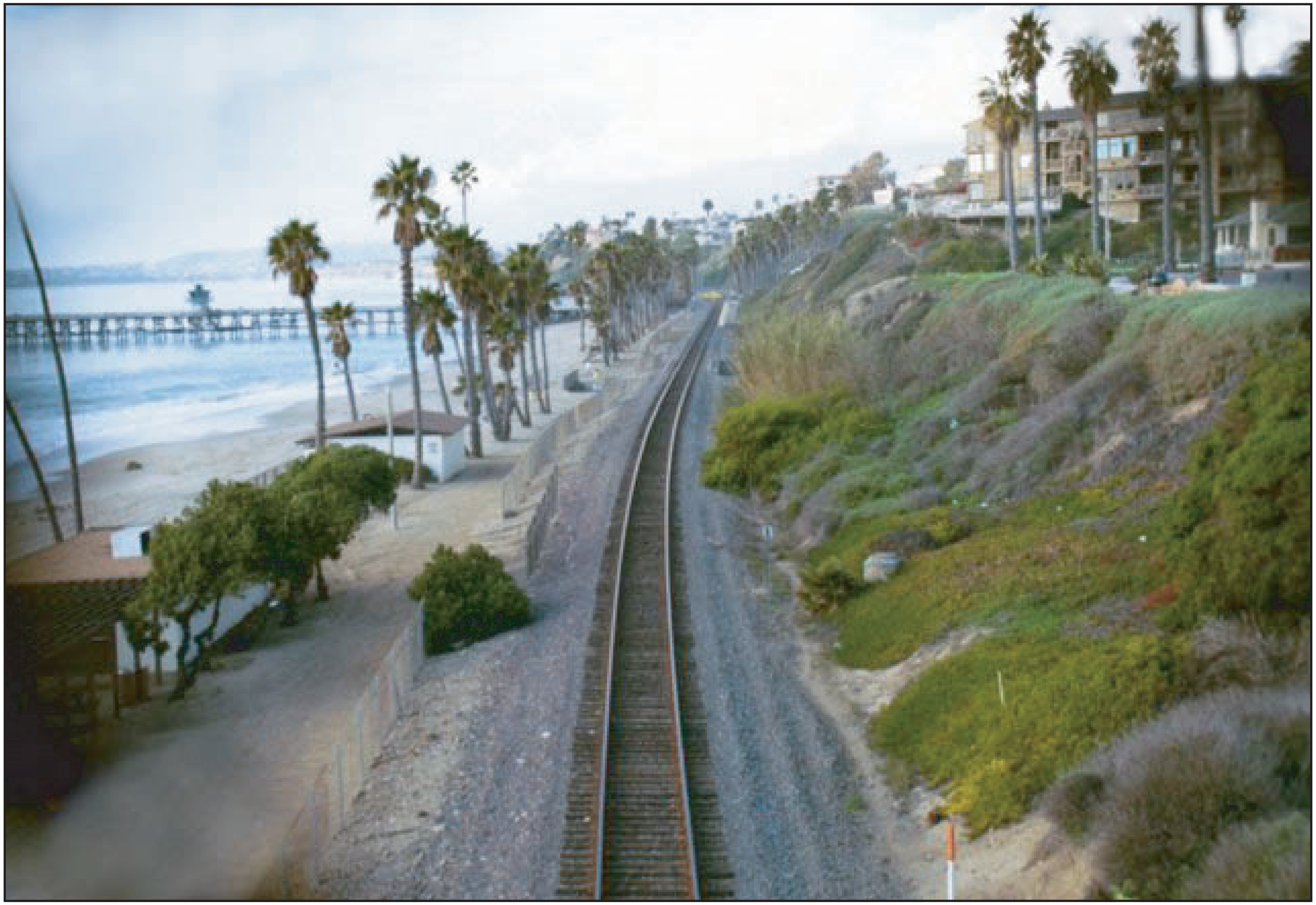
Existing LOSSAN Corridor - Carlsbad

U.S. Department
of Transportation
**Federal
Railroad
Administration**

FIGURE 3.7-1

Existing LOSSAN Corridor - Carlsbad

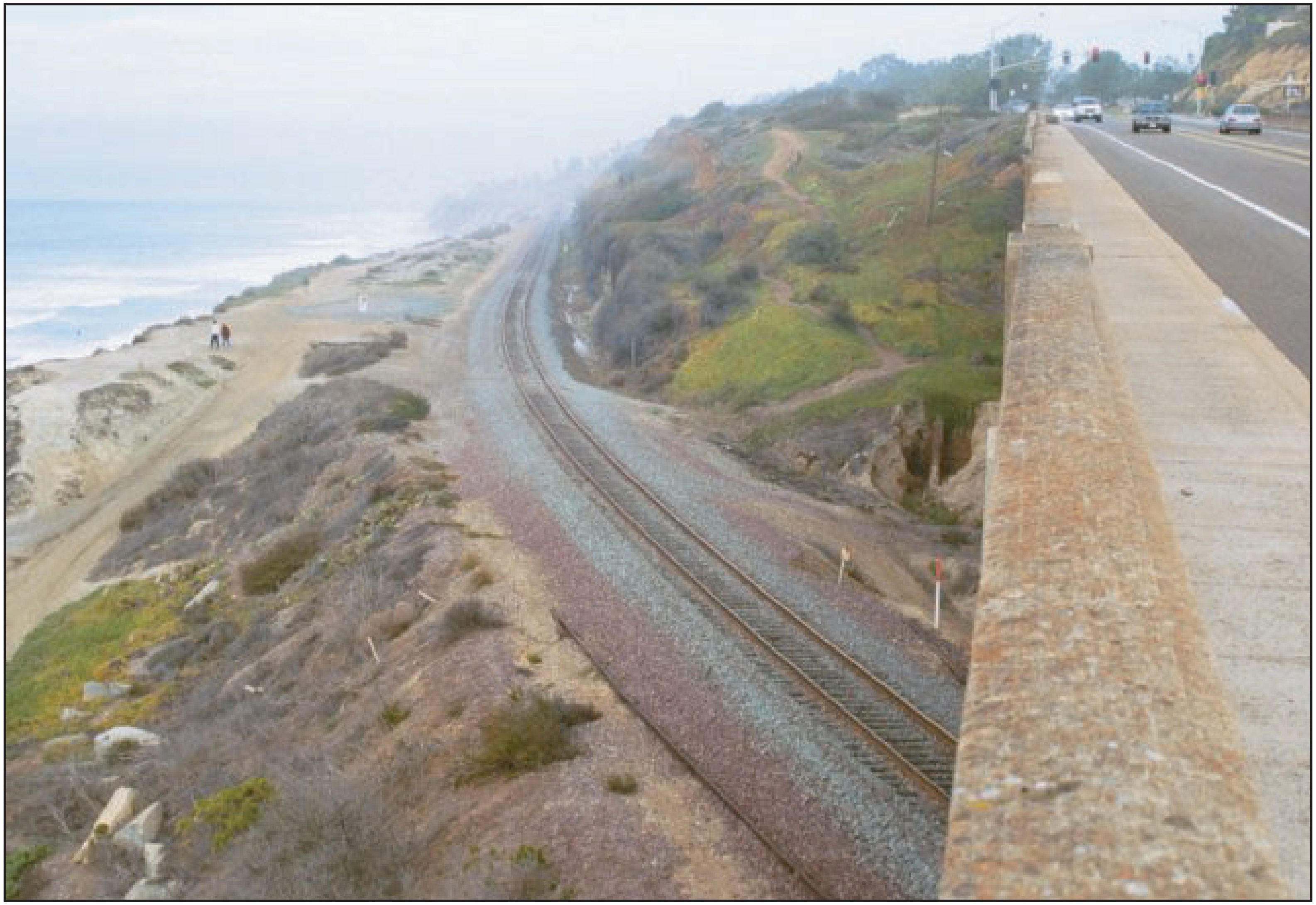
LOSSAN Rail Corridor Improvements
Program Environmental Impact Report / Environmental Impact Statement



Existing LOSSAN Corridor - San Clemente

U.S. Department
of Transportation
**Federal
Railroad
Administration**

FIGURE 3.7-2
Existing LOSSAN Corridor - San Clemente
LOSSAN Rail Corridor Improvements
Program Environmental Impact Report / Environmental Impact Statement



Existing LOSSAN Corridor - Del Mar Bluffs

U.S. Department of Transportation
Federal Railroad Administration

FIGURE 3.7-3

Existing LOSSAN Corridor - Del Mar Bluffs

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

Existing LOSSAN Bridge Structure Across San Elijo Lagoon

Caltrans

U.S. Department of Transportation
Federal Railroad Administration

FIGURE 3.7-4

Existing LOSSAN - Bridge Structure Across San Elijo Lagoon

LOSSAN Rail Corridor Improvements
Program Environmental Impact Report / Environmental Impact Statement

The highway projects approved and funded for construction by 2020 and included in the No Project Alternative are described in Chapter 2, *Alternatives*. In the LOSSAN region, these improvements or changes to the existing highways are generally expansions or reconfigurations of existing facilities that would not result in substantial visual contrasts or changes to the dominant line, form, color, or texture characterizing the existing landscape condition. No significant visual impacts, shadow, or glare impacts have been identified for the changes between the existing conditions and No Project Alternative for this program-level analysis. As these projects advance, the project sponsors may identify and address some localized visual impacts in separate environmental documentation.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

The comparison of potential aesthetic and visual resource impacts for the Rail Improvements Alternative is a broad overview of potential differences among alignment options for the construction (short-term) and operation (long-term), direct and indirect, and cumulative impacts. During construction, visual impacts would include the presence of construction equipment, the dismantling of old structures and erection of new structures, light and glare impacts from nighttime construction work, and contrast impacts from newly disturbed soils along the rail corridor. These impacts would be temporary, most occurring only during active construction periods along the corridor. Soil contrast impacts would last longer, but weathering of disturbed soils and revegetation would minimize the duration of these potential impacts.

Operational impacts would be long term visual effects of new, permanent structures, including track and stations or station additions. Table 3.7-1 summarizes the potential long-term visual contrast impacts and shadow impacts of the alignment options and station areas. These impacts are further described for each corridor segment in the following sections.

Table 3.7-1
Potential Visual Impacts

Rail Improvements Options	High Contrast Impacts (H/M/L/B)	Shadow Impacts (H/M/L)
Union Station To Fullerton Station – 4th Main Track	Low Area is highly urbanized and the proposed improvements would be consistent with existing environment	No impact
Fullerton Station To Irvine Station--Double Tracking		
AT-GRADE between Orange and Santa Ana	Low Area is highly urbanized and the proposed improvements would be consistent with existing environment	Low Grade separations at street intersections would create some shadow effects in urban areas
TRENCH between Orange and Santa Ana	Beneficial Impact Covered trench would remove at-grade rail infrastructure from view	No Impact

Table 3.7-1
Potential Visual Impacts (continued)

Rail Improvements Options	High Contrast Impacts (H/M/L/B)	Shadow Impacts (H/M/L)
Stations Fullerton	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
Anaheim	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
Santa Ana	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
Irvine	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
San Juan Capistrano Double Tracking		
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	Beneficial Impact Existing tracks would be removed into tunnel; new impacts would occur at tunnel portals but would be relatively minor	No impact
AT-GRADE and TRENCH along east side of Trabuco Creek	Medium New impacts to residential and commercial areas on west side of creek	Low Proposed structure widening over San Juan creek would increase shadow impacts but would be consistent with existing environment
Stations San Juan Capistrano	Low Proposed improvements to existing station would be consistent with existing environment	No impact
Dana Point/San Clemente Double Tracking		
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	Beneficial Impact Tunnel would remove existing rail along the coast and improve existing beach aesthetics	No impact
San Clemente - LONG TWO-SEGMENT TUNNEL; Double	Beneficial Impact Tunnel would remove existing rail along the coast and improve beach aesthetics	No Impact
Stations San Clemente	Low New station would add visual mass, parking and new light sources but station would be below-grade, minimizing its visibility	No Impact

Table 3.7-1
Potential Visual Impacts (continued)

Rail Improvements Options	High Contrast Impacts (H/M/L/B)	Shadow Impacts (H/M/L)
Camp Pendleton At-grade Double Tracking	Low Proposed improvements would not alter existing viewshed; additional infrastructure would not be discernable from distant viewing point	No Impact
Oceanside/Carlsbad Double Tracking		
Carlsbad - AT-GRADE; double tracking	Low Proposed improvements would be consistent with existing environment; additional infrastructure would not be discernable from distant viewing point	Low Proposed structure widening over lagoons would increase shadow impacts but would be consistent with existing environment
Carlsbad -TRENCH; double-tracking	Low Would remove existing at-grade tracks into trench through Carlsbad, but open-trench sections would require fencing; additional infrastructure would not be discernable from distant viewing point	Low Proposed structure widening over lagoons would increase shadow impacts but would be consistent with existing environment
Stations Oceanside	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
Encinitas/Solana Beach Double Tracking		
Encinitas - AT-GRADE;	Low Proposed improvements would be consistent with existing environment	Low Proposed grade separations and structure widening over lagoons would increase shadow impacts but would be consistent with existing environment
Encinitas - SHORT TRENCH	Beneficial Impact Covered trench would place existing tracks underground in part of the existing rail corridor	Low Proposed grade separations and structure widening over lagoons would increase shadow impacts but would be consistent with existing environment
Stations Solana Beach	Low Proposed improvements at existing station would be consistent with existing environment	No Impact
Del Mar Double Tracking		
TUNNEL under Camino Del Mar	Beneficial Impact Tunnel option would remove existing tracks from bluffs and place them underground	Low Proposed structure widening over lagoons would increase shadow impacts but would be consistent with existing environment

Table 3.7-1
Potential Visual Impacts (continued)

Rail Improvements Options	High Contrast Impacts (H/M/L/B)	Shadow Impacts (H/M/L)
TUNNEL along I-5	Medium Tunnel would remove existing tracks and place underground, but new visual impacts to residential views would result from elevated rail structure south of San Dieguito Lagoon, and from tunnel portal/transition located between two residential areas	Low Tunnel would remove existing rail structure across Penasquitos Lagoon but structure over San Dieguito Lagoon would be widened, and elevated structure across south end of lagoon would add new shadow impacts
I-5/805 Split To Hwy 52 Double Tracking		
Miramar Hill TUNNEL	No Impact Proposed tunnel improvement	No Impact Proposed tunnel improvement
I-5 TUNNEL	No Impact Proposed tunnel improvement	No Impact Proposed tunnel improvement
Stations UTC (Only applies to Miramar Hill Tunnel)	No Impact Proposed station would be underground	No Impact Proposed station would be underground
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	Low Proposed improvements would be consistent with existing environment	Low New bridge structures over wetlands and creeks would increase shadow effects in these areas
Stations Santa Fe Depot	Low Proposed improvements at existing station would be consistent with existing environment	No Impact

Union Station to Irvine

Proposed rail improvements between Union Station and Fullerton Station would consist of a fourth main track within the existing rail corridor. The majority of this segment traverses through a heavily developed area of existing residential, business, and industrial/commercial uses adjacent to the existing corridor. Low visual impacts are anticipated for this segment because the improvements would be consistent with the existing environment and existing rail corridor.

The LOSSAN corridor between Fullerton Station and Irvine Station traverses through an urbanized and heavily developed area that includes residential, business, and industrial structures. The at-grade option for corridor improvements would be consistent with the existing environment and rail corridor. The covered trench option would have a beneficial impact on the existing visual environment by moving the at-grade tracks into a covered trench and eliminating the view of operating trains.

San Juan Capistrano

The tunnel option in San Juan Capistrano would follow the I-5 corridor, located east of the existing rail corridor. The tunnel would remove the tracks from the viewshed of surrounding areas and uses adjacent to the existing corridor, thus improving the existing visual environment. There would be new visual impacts created at the tunnel portals but these impacts would be low, and the removal of the existing at-grade tracks would result in an overall benefit to area aesthetics.

The other option through San Juan Capistrano would consist of a cut-and-cover and open trench and at-grade alignment west of the existing rail corridor, along the east side of Trabuco Creek. Although portions of this alignment would be below grade, the at-grade sections would create a new rail corridor and operating trains along the creek. This would cause impacts to the viewshed of residences along the west side of Trabuco Creek, and office/commercial uses and a private school located east of the creek. A pedestrian overpass may be needed at one or more locations across the trench, which would also create a new visual mass and shadow effects in the area. Because this option introduces new visual impacts to the residential and commercial uses in the vicinity, this option was evaluated as having a Medium visual impact.

Dana Point/San Clemente

The potential Dana Point curve realignment is located in a heavy industrial area. The realignment would cross underneath Pacific Coast Highway 1 (PCH) and the tracks would be located southwest of the existing tracks and a hotel. The realignment is consistent with the existing environment, and would not introduce a new visual impact to the area or the hotel. Low visual impacts are anticipated for the realignment.

Rail improvements proposed through the City of San Clemente and portions of southern Dana Point include double tracking with tunnel options. Both tunnel options follow the I-5 corridor. The existing rail corridor through San Clemente and southern Dana Point is along the coastline on the beach/shore. The tunnel options through south Dana Point and San Clemente would reduce existing visual impacts to the residential areas, beaches, and PCH traffic because the tracks would be underground in an alignment that follows I-5. The tunnel options would improve the viewshed from homes, beaches, and roadways.

The existing rail corridor is constructed along the toe slope of the bluffs in San Clemente, which creates visual impacts to the area beachfronts and shoreline residences. The Rail Improvements Alternative would potentially result in a beneficial visual impact to these bluff areas by precluding further rail construction along the bluffs and removing the existing rail service from the bluff areas.

Camp Pendleton

Camp Pendleton is primarily undeveloped land aside from the I-5 corridor and the San Onofre power plant. The existing rail corridor traverses through Camp Pendleton and the proposed improvements would not alter the viewshed from I-5, the rest stops and viewing points from I-5, or San Onofre State Beach. Low, largely indiscernible impacts would occur through Camp Pendleton.

Carlsbad

Proposed rail improvements through Carlsbad include double tracking in either an at-grade or a trench alignment. Both options would be consistent with the existing environment at Buena Vista Lagoon, north of Carlsbad, but the bridge would be widened so shadow impacts would increase somewhat. The existing tracks traverse through residential and commercial/business districts. The at-grade option would be consistent with the existing environment and existing tracks. The trench option would reduce visual impacts because the existing tracks would be set behind businesses and below grade. Open trench sections would have to be fenced for security, so at-grade visual impacts would occur. Both options would be consistent with the current environment at Agua Hedionda Lagoon and Batiquitos Lagoon, but the widening of bridge structures would increase the visual mass and shadow impacts in these crossing areas. Both lagoons are located east of Coast Highway 101 (101) and west of I-5 with residential areas located to the north and south of the lagoons. The two options would be generally consistent with the current environment and existing tracks. Low impacts are anticipated for the improvements through Carlsbad and the lagoons.

Encinitas

Alignment options through the City of Encinitas include at-grade or trenching. Grade separations would be provided at major intersections. A mixture of land uses can be found along the existing rail corridor in the area, including residential and business/ commercial areas. The at-grade option would reconfigure the intersection of Birmingham Drive and San Elijo Avenue, close Chesterfield Drive at San Elijo Avenue, and modify Leucadia Boulevard. A short trench section would be located at Birmingham Drive to improve vehicle and pedestrian traffic across the existing tracks. The 101 would be elevated to accommodate Birmingham Drive. The closure of Chesterfield Drive would eliminate the crossing with the existing tracks. In addition, the tracks would be depressed and Leucadia Boulevard would run above the tracks and the 101. San Elijo Lagoon is located north of Solana Beach, east of 101 and west of I-5 with residential areas located to the north and south of the lagoon and a few businesses and restaurants along the 101 adjacent to the lagoon. The grade separations and structure widening over the San Elijo Lagoon would increase shadow impacts in these areas, but would be consistent with the existing visual environment. Impacts of the at-grade option are evaluated as Low.

The trenching option would improve the existing visual characteristics of the area and would have a beneficial impact. The tracks would be depressed, thus removing the existing rail infrastructure from views along the corridor from residential and business areas. Grade separations would create new visual mass and some shadow impacts in the urban environment. Structure widening over the lagoon would increase shadow effects but would be consistent with the existing aesthetics. Visual impacts are rated as Low for the trench option through Encinitas and across San Elijo Lagoon.

Del Mar

Proposed rail improvements through the City of Del Mar include double tracking with two tunnel options. Land uses along the existing rail corridor in this area include residential areas, a restaurant and the Del Mar Fairgrounds and Racetrack at the north end near the San Dieguito Lagoon; residential development through most of Del Mar; and the Los Penasquitos Lagoon on the south end. The Camino del Mar tunnel option would remove the existing tracks from the bluffs and place them in a tunnel under the street through Del Mar, resulting in a beneficial impact on area aesthetics and the coastal viewshed. While the two tunnel portals would have some visual impact, the impact would be within the urban environment along transportation corridors (roadway and rail), and would not substantially alter existing aesthetics.

The I-5 tunnel option would also remove the existing tracks from the bluffs and remove the existing rail structure crossing the Penasquitos Lagoon, improving the views from some residences, the beaches/bluffs and the lagoon. This tunnel option, however, would create new visual impacts and shadow impacts for residents along the south edge of the San Dieguito Lagoon where an elevated rail structure would be located. The existing San Dieguito Lagoon Bridge would be rebuilt to accommodate the double tracking, increasing the existing shadow effects somewhat. The southern tunnel portal would be located at the edge of the Los Penasquitos Lagoon. The northern portal and tunnel-transition area would be located between two clustered residential areas, creating a new visual impact in the near-views from these homes. Therefore, despite removal of the track from the bluffs, the impacts of the elevated structure, portals and tunnel-transition areas would result in an overall Medium level of visual impact for the I-5 tunnel option.

I-5/805 Split to Highway 52

Proposed rail improvements between the I-5/805 split and Highway 52 consist of two tunnel options. One option would traverse through Miramar Hill and into La Jolla and the University Towne Centre (UTC) area. The other tunnel option would follow the I-5 corridor. Either tunnel would connect to the existing rail corridor in Sorrento Valley near the intersection of I-5 and Highway 52. The tunnel options would avoid visual impacts to the homes, beaches, roadways, businesses, and schools.

Highway 52 to Santa Fe Depot

Proposed rail improvements between Highway 52 and the Santa Fe Depot include the Elvira curve realignment and double tracking. The curve realignment would be located at-grade within the San Clemente Canyon area near Highway 52 and south through an urbanized and developed area with business and industrial buildings to just south of Balboa Avenue. Potential minor visual impacts to the public recreational uses and two bridge structures at San Clemente Canyon may occur with the realignment. Low visual impacts are anticipated in the area of the Elvira Curve, specifically through the San Clemente Canyon.

In the area just south of the Elvira Curve realignment towards Taylor Street, double tracking would be done in the existing rail right-of-way through a heavily urbanized (business/industrial with light residential) area parallel to I-5. The bridge crossing design at the San Diego River would be consistent with the current environment and existing rail corridor and thus would not alter the viewshed. Double tracking would be done within the existing rail right-of-way as it enters downtown San Diego and the Santa Fe Depot through an existing urbanized area parallel to I-5. Double tracking within the existing rail corridor would not create any new visual impacts on the existing viewshed.

Rail Stations

Except where otherwise noted below, proposed station improvements along the LOSSAN corridor would involve adding bypass tracks and/or additional parking at existing stations. These impacts would all be Low and nearly unnoticeable. New stations are proposed as part of three alignment options. As described below, two of those proposed stations would be below-grade in a trench, and one would be underground. Existing visual settings at the stations are briefly summarized below.

- Fullerton Station is located in a heavily developed area of existing residential, business, and industrial/commercial uses.
- Anaheim Station is located within the parking lot of Edison Field and an adjacent business park.
- Santa Ana Station is located in an urbanized area with industrial and residential uses.
- Irvine Station is located in a developed area that includes industrial uses and the old El Toro Marine Corps Air Station.
- In San Juan Capistrano, the Trabuco Creek at-grade and trenching option would involve construction of a new station, which would be located below-grade in an open trench. This station would result in Low impacts on the surrounding area, due to the introduction of (below-grade) visual mass of the structure, new parking area, and new light sources.
- In San Clemente, a new below-grade station would be constructed along the long, two-segment tunnel alignment where the tunnel would transition to a trench just south of Avenida Pico on the east side of I-5. Similarly, for the short tunnel option, a new station would be located at Avenida Pico near Calle De Los Molinos. Either of these stations would create Low visual impacts due to the addition of (below-grade) visual mass of the structure, parking areas, and new light sources.
- The Oceanside Station is located within an urbanized area with commercial and residential uses.
- The Solana Beach Station is located adjacent to the Cedros Design District (businesses and commercial shops) and some scattered residences.
- For the Miramar Hill Tunnel option, a new underground station is proposed in the La Jolla/University Towne Centre area, which is primarily developed with a mix of residential and commercial uses. The underground station would not create any visual contrast, shadow or light and glare impacts.
- The Santa Fe Depot is located in downtown San Diego in an urbanized and redeveloped area with mixed uses of residential and commercial.

3.7.4 Mitigation Strategies

General mitigation strategies would include the design of proposed facilities that are attractive in their own right and that would integrate well into landscape contexts, so as to reduce potential view blockage, contrast with existing landscape settings, light and shadow effects, and other potential visual impacts. Further consultation with local and regional agencies and with the public would help the Department refine these general mitigation strategies during project-level environmental review. The following measures could be considered during subsequent review and design development to enhance project appearance and minimize project visual impacts.

- Bridges and other elevated rail infrastructure could be designed with graceful lines and with minimal apparent bulk and potential shading effects. Features that could be considered include use of contoured, rounded edges for columns and other structural elements.

- In the LOSSAN corridor, the existing rail line crosses six lagoons. The existing structures across the lagoons have been in place for many years, and are relatively dense, opaque structures. The proposed double tracking in these areas presents a potential for opening up the views in some of the lagoon areas, if new structures are constructed across the lagoons. Although the rebuilding of structures, and removal of the existing ones, is not proposed at this time as part of the improvement options, it may be proposed during project-level review as a means of mitigating potential impacts to hydrologic and biological resources associated with the lagoons. (See Section 3.12, *Hydrology and Water Resources*, and Section 3.13, *Biological Resources and Wetlands*.)

  As an illustration of how structure replacement could open up lagoon views, Figure 3.7-5 shows the existing structure across San Elijo Lagoon, and a photo-simulation of a new structure type that represents one possible means of replacing the existing structure. As shown in the figure, the views across the lagoon would be opened up and expanded with a more open-cell structure with widely spaced support columns. Causeway structures may also be considered for some lagoon crossings in project-level reviews. The photo-simulation illustrates only the potential for opening up views across the lagoon, and does not represent the level of design effort that would be done at a project-level assessment. Context-sensitive designs would be developed for replacement structures, taking into account the localized aesthetic environment and public input.

- Where at-grade or depressed route segments pass through or along the edge of residential areas or heavily traveled roadways, landscape treatments could be installed along the edge of the right-of-way such as trees, shrubs, and groundcover to provide partial screening and to visually integrate the right-of-way into the residential context.

- Night lighting at stations should be the minimum required for operations and safety. All lights should be hooded and directed to the area where the lighting is required to minimize excess shedding of waste light. For lights that are not required to be on all the time, sensors and timers should be specified.

3.7.5 Subsequent Analysis

Specific analyses that would be appropriate for project-specific environmental evaluation are discussed below.

- Analyses of potential visual effects would be performed, particularly in areas with elevated structures, to identify potential visual intrusions into residential and park and open space areas. These analyses should focus on identifying the potential for obstruction of valued views; the areas where shadows would be cast on residential and open space lands; and the areas where the scale, form, line, and color of project facilities would substantially alter the existing character and quality of the setting. In addition to producing a detailed inventory of area-specific impacts, this analysis would serve as the basis for identifying areas where project siting adjustments and design modifications, landscaping, and other design measures may be incorporated to avoid potentially significant impacts.

- Review of local urban design plans and policies should be conducted to take into account local design objectives. The analyses would provide a basis for considering specific design measures that would modify the impacts of the project in ways that would make the project design more consistent with local urban design goals.

For each of the proposed below-grade station sites, further analyses should be conducted in consultation with local agencies to develop an understanding of the relationship of the proposed station architecture, parking lots, lighting systems, and other features to the surrounding natural and built setting and historic context of the surrounding landscape setting. The analyses should identify areas where the scale, form, line, and color of project facilities could be designed to blend with the surrounding landscape. The analyses would be used to provide a basis for considering specific measures that could be integrated into the final station designs to reduce the visual impacts of the stations on their surroundings.

Existing LOSSAN Bridge Structure Across San Elijo Lagoon

Photo-Simulation -New Bridge Structure Across San Elijo Lagoon

Source : Company 39, 2003

U.S. Department
of Transportation
**Federal
Railroad
Administration**

FIGURE 3.7-5

Photo-Simulation
New Bridge Structure Across San Elijo Lagoon

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3.8 PUBLIC UTILITIES

This section describes the existing public utilities within the project area and identifies the potential for impacts on utility systems for the No Project and Rail Improvements Alternatives. The public utilities evaluated in this section include electrical transmission lines, natural gas facilities, and wastewater treatment facilities. A potential utility impact is any potential conflict between an alignment or station and a utility, including crossings regardless of depth or height.

3.8.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

California Public Utilities Commission

The California Public Utilities Commission (CPUC) primarily regulates the provision of privately owned utilities in California. These utilities include privately owned telecommunications, electric, natural gas, water, railroad, rail transit, and passenger transportation companies. The CPUC is responsible for assuring that California utility customers have safe, reliable utility services at reasonable rates; protecting utility customers from fraud; and promoting the health of California's economy. The CPUC does not issue permits for proposed projects that would cross utility lines. The CPUC does, however, regulate at-grade rail crossings and, therefore, the Rail Improvement Alternative would require CPUC approval.

Office of the State Fire Marshall

The Office of the State Fire Marshall, Pipeline Safety Division, regulates the safety of approximately 5,500 mi (8,851 km) of intrastate hazardous liquid (e.g., oil, gas) transportation pipelines and acts as an agent of the Federal Office of Pipeline Safety concerning the inspection of more than 2,000 mi (3,219 km) of interstate pipelines. Pipeline safety staff inspects, tests, and investigates to ensure compliance with all federal and state pipeline safety laws and regulations. All spills, ruptures, fires, or similar incidents are responded to immediately; all such accidents are investigated for cause.

Research and Special Programs Administration, U.S. Department of Transportation

The Research and Special Programs Administration (RSPA), U.S. Department of Transportation is responsible for carrying out the duties regarding pipeline safety set forth in 49 U.S.C. §§ 60101 et seq. and 49 C.F.R. §190.1. The regulations apply to the owners and operators of the facilities and cover the design, installation, inspection, emergency plans and procedures, testing, construction, extension, operation, replacement, and maintenance of pipeline facilities transporting oil, gas and hazardous liquid. The regulations require operators of gas pipelines to participate in a public safety program, such as a one-call system that would notify the operator of any proposed demolition, excavation, tunneling, or construction that would take place near or affect the facility.

Wastewater Regulatory Setting

Many regulatory agencies are involved in wastewater treatment oversight. These agencies include the U.S. Environmental Protection Agency (EPA), the California Water

Resources Control Board (CWRCB), and nine California Regional Water Quality Control Boards (RWQCBs). Primary wastewater regulation occurs via the issuance of wastewater discharge standards that are implemented through National Pollutant Discharge Elimination System (NPDES) permits and waste discharge requirements issued by the various RWQCBs.

Wastewater conveyance and treatment facilities in the study area are owned and/or operated by different agencies and entities. Any potential conflict with such facilities would be addressed in consultation with the respective agency. If a proposed rail improvement alignment option would require use of wastewater facility properties, the need for easements, agreements, or other arrangements with the agency and/or local jurisdiction would be considered and addressed.

B. METHOD OF EVALUATION OF IMPACTS

Various methods, including the following, were used to gather the appropriate information for the study area:

- Review of the project Geographical Information System (GIS) to identify cities and counties in the study area.
- Review of the general plans for potentially affected communities in which proposed alignment options are being studied, as well as maps from the Thomas Bros. California Atlas and from the California State Automobile Association.
- Review of project alignments/proposed improvements against GIS information of electrical transmission lines, and gas and oil pipelines compiled by Pennwell MAPSearch (2003).
- Exploration of Web sites of the GIS-identified cities and counties in the study area, to gather appropriate setting information.
- Examination of applicable utility system maps and Web sites to gain a better understanding of facility distribution.
- Contact with public utility providers via telephone to obtain or confirm the locations of their current and planned services and facilities in the study area.

Public utilities can generally include a range of services such as water, power, sewage, communications, and other systems. For the purposes of this analysis, three of the most common major facilities that may pose construction challenges were identified to best represent potential utility impacts. These facilities not only provide critical services, they are likely to create a hazard if damaged during construction operations.

- Electrical facilities are defined as major transmission lines and substations that meet or exceed a power rating of 230 kilovolts (kV).
- Natural gas facilities are defined as high-pressure gas pipelines and facilities of various sizes.
- Wastewater treatment facilities are defined as wastewater pipelines with a minimum 36-in (91-cm) diameter, and any treatment facilities located an alignment option corridor.

The methodology used to assess potential conflicts (any crossing or longitudinal encroachment of an existing utility by the defined improvement) included overlaying the available utility maps with the alignment options and identifying the facilities within 100 ft (30 m) of the centerline and the proposed alignment options. Because public utilities are so prevalent throughout the study area, it was not practical to assess each potential conflict. Rather, the relative impact between alignment options was determined by quantifying the number and type of potential conflicts for each option. In addition, a qualitative ranking of high, medium, or low was assigned to describe the potential severity of the conflict, as described below and summarized in Table 3.8-1.

Linear facilities, such as electric transmission lines, natural gas pipelines, and wastewater pipelines, would be less likely to be affected by an alignment option because, with relatively minimal disruption or construction impacts, they could be avoided, or conflicts could be minimized or mitigated by routing either the public utility or the rail improvement around, over, or under the facility. Where unavoidable, relocations of the utilities would not pose adverse environmental risks, based on current construction practices. However, they do represent additional project-related costs.

Fixed facilities, such as electrical substations or power stations and wastewater treatment plants, would be more likely to be affected by a rail alignment option because they could require more significant engineering, design, and construction to avoid, minimize, or mitigate potential conflicts. These types of fixed facilities have more significant constraints regarding any potential conflict such as routing the transportation improvement around, over, or under the facility, or relocating the fixed facility to another location.

Table 3.8-1
Rankings for Potential Public Utilities Impacts/Conflicts

Potential Impact Ranking	Electrical Facilities	Natural Gas Lines	Waste Treatment Facilities
Low	No 230kV or greater facility within study area	1 to 15 gas lines within study area	No wastewater pipelines of 36-in (91-cm) diameter or greater or treatment facilities within study area.
Medium	N/A*	16 to 30 gas lines within study area	N/A*
High	One or more 230kV or greater facility, substation, or power station within study area	31 or more gas lines within study area	Wastewater pipelines of 36-in (91-cm) diameter or greater or treatment facilities within study area.

* There is no medium rating for this category; impacts are either low (no facilities in the segment) or high (one facility or more in the segment).

3.8.2 Affected Environment

A. STUDY AREA DEFINED

The study area for public utilities encompasses the area within 100 ft (30 m) of the centerline of each alignment and 100 ft (30 m) around stations. The study area is generally located within developed and urbanized areas. These areas typically include various underground, at-grade, and elevated utilities that provide water, power, communications, and sewage service to residential, business and manufacturing, and agricultural practices.

B. PUBLIC UTILITIES IN STUDY AREA

Figure 3.8-1 illustrates the major utilities that are present in the LOSSAN study area. The key service providers and resources in the LOSSAN study area are summarized below.

- Electrical Facilities—Providers include Los Angeles Department of Water and Power (LADWP); Southern California Edison (SCE); and Sempra Energy/San Diego Gas & Electric (SDG&E).
- Natural Gas Facilities—Provided by Southern California Gas (SCG) and two wholesale utility customers -- SDG&E and Southwest Gas Corporation.
- Wastewater Treatment—Provided primarily by San Diego Metropolitan Wastewater District, Encina Wastewater Authority, San Elijo Joint Powers Authority, United States Marine Corps, and South Orange Wastewater Authority.

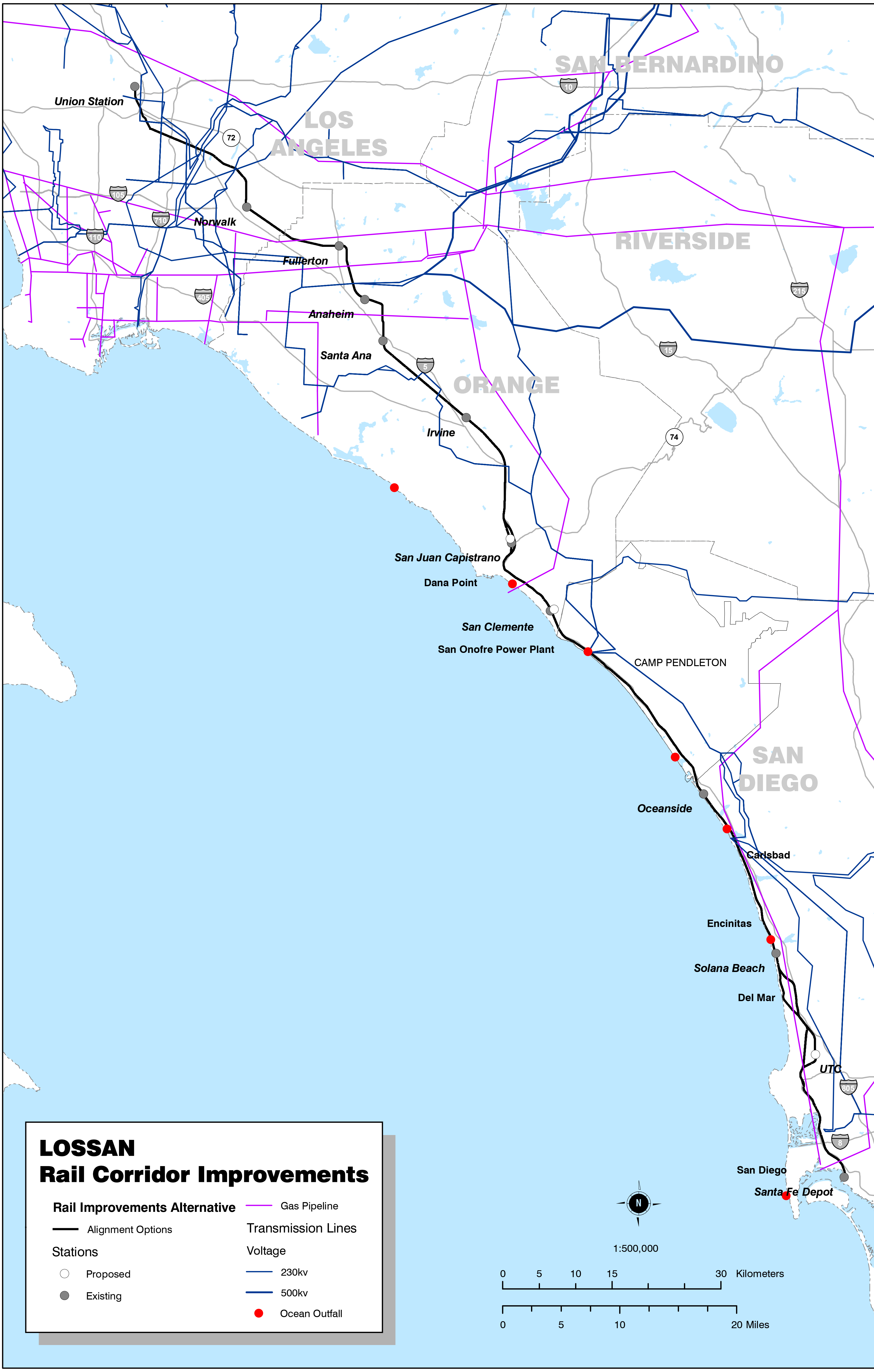
3.8.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The existing conditions assume the continued operation of the transportation and public utilities infrastructure described above. The No Project Alternative assumes that, in addition to existing conditions, additional transportation and utility improvements will be developed and operational by 2020. The transportation improvements include projects that are programmed or funded to 2020 (as described in Chapter 2, Alternatives).

It was not possible as part of this study to identify or quantify the utility improvements expected to occur by 2020. Rather, it is assumed that utility development will occur to meet projected demand and growth characteristics near the alignment options of the proposed Rail Improvement Alternative. For existing transportation facilities, conflicts with electrical transmission lines, natural gas pipelines, oil pipelines, wastewater and water utilities, and other utilities have previously been addressed and few additional or increased impacts are expected from the future transportation improvements included in the No Project Alternative. In addition, it is assumed that measures would be taken to avoid these potential conflicts to the extent feasible and practical, as well as to greatly limit any potential additional costs or disruption of service. It is common practice to coordinate onsite with utility representatives during construction in the vicinity of critical infrastructure such as high-voltage overhead/underground transmission lines, high-pressure gas pipelines, or aqueduct canals. Also, future transportation or utility improvements would be expected to be analyzed in a project-level environmental document, which would incorporate feasible measures to mitigate potentially significant adverse environmental impacts.

Based on the above assumptions, the existing conditions of the No Project Alternative are used to provide the baseline for analysis of potential conflicts with utilities.



LOSSAN
Rail Corridor Improvements

Rail Improvements Alternative

Alignment Options

Stations

Proposed

Existing

Gas Pipeline

Transmission Lines

Voltage

230kv

500kv

Ocean Outfall

Source : EIAGIS, 2001

U.S. Department of Transportation
Federal Railroad Administration

Caltrans

FIGURE 3.8-1

Major Utilities

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

B. NO PROJECT COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Existing conditions from the No Project Alternative provide the baseline condition. Improvements associated with the proposed Rail Improvements Alternative would result in potential impacts in addition to those resulting from the No Project Alternative. With respect to public utilities, the analysis did not show significant differences when comparing the No Project Alternative to the Rail Improvements Alternative, or comparing the various alignment options. As described above, the number of potential utility conflicts under the No Project Alternative was not identified, and existing conditions were used as the baseline for analysis. For the purposes of this analysis, the existing conditions are treated as representative of the No Project Alternative, and the analysis summarizes the relative differences between the existing conditions and the Rail Improvement Alternative.

Table 3.8-2 summarizes the potential impacts of the alignment options on the various public utilities examined as part of this document.

Table 3.8-2
Potential Utility Conflicts

Rail Improvement Design Options	Electrical Transmission Lines	Electrical Substations	Natural Gas Pipelines	Wastewater Treatment Pipelines & Sewer Outfalls
Union Station To Fullerton Station 4th Main Track	15	0	24	0
Fullerton Station To Irvine Station Double Tracking				
AT-GRADE between Orange and Santa Ana	4	1	6	0
TRENCH between Orange and Santa Ana	4	1	6	0
Stations Fullerton	0	0	0	0
Anaheim	0	0	0	0
Santa Ana	0	0	2	0
Irvine	0	0	0	0
San Juan Capistrano Double Tracking				
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	0	0	0	0
AT-GRADE and Cut/Cover TRENCH along east side of Trabuco Creek	0	0	0	0
Stations San Juan Capistrano	0	0	0	0

Table 3.8-2
Potential Utility Conflicts (continued)

Rail Improvement Design Options	Electrical Transmission Lines	Electrical Substations	Natural Gas Pipelines	Wastewater Treatment Pipelines & Sewer Outfalls
Dana Point/San Clemente Double Tracking				
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	0	0	1	1
San Clemente - LONG TWO-SEGMENT TUNNEL	0	0	1	1
Stations San Clemente	0	0	0	0
Camp Pendleton At-grade Double Tracking	0	0	0	2
Oceanside/Carlsbad Double Tracking				
Carlsbad - AT-GRADE	2	0	0	0
Carlsbad -TRENCH	2	0	0	0
Stations Oceanside	0	0	0	0
Encinitas/Solana Beach Double Tracking				
Encinitas - AT-GRADE	0	0	0	1
Encinitas - SHORT TRENCH	0	0	0	1
Stations Solana Beach	0	0	0	0
Del Mar Double Tracking				
TUNNEL under Camino Del Mar	0	0	0	0
TUNNEL along I-5	0	0	0	0
I-5/805 Split To Hwy 52 Double Tracking				
Miramar Hill TUNNEL	0	0	9	1
I-5 TUNNEL	0	0	9	1
Stations UTC (Miramar Hill Tunnel only)	0	0	0	0
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	0	0	4	1
Stations Santa Fe Depot	0	1	0	0

Overall, the analysis indicated that, with regard to potential conflicts with utilities, there was little difference between and among the proposed alignment options. This is because utilities generally do not present significant potential impacts that cannot be avoided, minimized, or mitigated through conventional design and construction processes. For instance, most potential conflicts typically would be identified during the design or construction stage of a project and standard measures would be taken to minimize costs and disruption of service.

Twenty-one 230kV transmission lines are crossed by proposed alignment options between Los Angeles and San Diego. Nineteen of these transmission lines are located in the Union Station to Irvine Station segment, leaving the rest of the corridor relatively free of higher voltage electrical facilities. Two substations were identified in the study area, one located in the Fullerton to Irvine segment, and one near the Santa Fe Depot in San Diego. Actual impacts in the existing LOSSAN rail corridor are likely to be low because the rail pre-dates the electrical infrastructure that has been developed around the existing and operating LOSSAN rail corridor.

High-pressure natural gas pipelines, ranging in diameter from 4 inches to 30 inches, are crossed by the proposed rail alignment options in 44 locations, and 2 locations within the Santa Ana Station study area. In all but one area, these gas lines are distributed such that construction activities would result in low or no impacts. Only in the Union Station to Fullerton Station segment are impacts considered to be higher, where the alignment options cross 24 gas lines. It is assumed that any construction in this corridor would require gas lines to be exposed through excavation and then re-cased for protection.

Additional impacts to gas pipelines could result in areas where tunneling and trenching require minor or major pipeline relocations, or where utilities are excluded from the corridor. Tunneling and trenching may occur in the Union Station to Fullerton segment (24 pipelines), Fullerton to Irvine Station segment (6 pipelines), Dana Point/San Clemente segment (1 pipeline), I-5/805 Split to Highway 52 segment (9 pipelines), and the Highway 52 to Santa Fe Depot segment (4 pipelines). In most cases, potential impacts relate to construction cost and time, and should not result in disruption of service.

Wastewater treatment facilities intersecting the various alignment options include five treated wastewater ocean outfalls and two major sewer lines. No wastewater treatment plants were identified within the study area. The ocean outfalls are located in the Dana Point/San Clemente segment (1), Camp Pendleton segment (2), Oceanside/Carlsbad segment (1), and the Encinitas/Solana Beach segment (1). Major sewer lines include a 60-inch-diameter line that enters the rail corridor in the I-5/805 Split to Highway 52 segment and parallels it to the Airport pump station and a 96-inch trunk line in the Highway 52 to Santa Fe Depot segment. Impacts to ocean outfalls and sewer trunk lines are rated as high due to high relocation impacts because of their large diameter, high construction costs and time, and potential for service interruption.

3.8.4 Mitigation Strategies

Potential general mitigation strategies for potential utility conflicts should first focus on avoidance of the potential conflicts. If such conflicts are unavoidable, the next strategy should focus on reducing and minimizing the potential impact. The mitigation strategies would be refined during subsequent project-specific review.

For large utilities, such as wastewater treatment facilities, electrical substations, and pipelines, the strategy would be first to avoid crossing or using any of the utility right-of-way or facility footprint as the project-specific review proceeds and as engineering designs are refined. Avoidance opportunities should include consideration of modifying both the horizontal and vertical profiles of the proposed transportation improvements.

If avoidance is not feasible, and adjustment of alignments has not eliminated potential conflict, then in close coordination with the utility owner, relocation/reconstruction/restoration of the utility should be considered as a second mitigation strategy. This type of mitigation could include combining several utilities into a single utility corridor, or relocation or reconstruction. Where feasible and cost-effective, consolidating several utilities, primarily underground electrical and communications utilities, into one conduit should be considered during utility relocation planning.

3.8.5 Subsequent Analysis

As previously mentioned the public utilities impact analysis is programmatic and addresses only representative utilities; it does not address all utilities and does not address local details. Project-level analysis would address all utilities and local issues once the alignments are defined. Project-level environmental documentation and subsequent planning documents should include more detailed information on the following utilities.

- Water supply lines.
- Wastewater conveyance lines.
- Wastewater and water pump stations.
- Storm drains.
- Fiber optic lines.
- Telecommunication lines.
- Other utilities, and pipelines likely to be crossed or conflict with the various alignment options, including liquid petroleum, crude oil, etc.

3.9 HAZARDOUS MATERIALS AND WASTES

This section identifies the potential for impacts on areas that may be contaminated with hazardous materials and/or wastes for the No Project and Rail Improvements Alternatives. According to Title 22, Section 66261 of the California Code of Regulations (CCR), waste is considered hazardous if it exhibits at least one of the four characteristics of ignitability, corrosivity, reactivity, or toxicity, or if it is a "listed waste." Waste can be liquid, semi-solid, or gaseous. A potential hazardous waste impact is any potential conflict between an alignment, station, or airport facility and a known contaminated site, including crossings of a known contaminated site regardless of depth or height. The section focuses on contamination at sites on the National Priorities List (NPL)/Superfund, California's high-priority Annual Work Plan (AWP) sites, and solid waste landfill (SWLF) sites.

3.9.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Hazardous materials and waste sites, including their use and remediation, are regulated by a number of federal laws, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response and Liability Act (CERCLA).

California's hazardous materials regulations for the discovery of hazardous substances in the subsurface during construction, and the disposal of hazardous materials and cleanup of the hazards area incorporate most federal hazardous materials regulations. California's statutes and regulations on hazardous materials are contained in Health and Safety Code (HSC) 25130 et seq. and CCR Title 22, which contains regulations adopted and administered by the California Department of Toxic Substances Control (DTSC). California regulations require that hazardous waste be managed according to applicable regulations that include worker operational safety procedures as identified in Title 8 CCR; handling, storage, and exposure requirements; transportation and disposal requirements under a uniform hazardous waste manifest; and documentation procedures. In California, waste disposal facilities are classified in three categories: Class I, Class II, and Class III. A Class I disposal facility may accept federal and California hazardous waste. Class II and Class III facilities are only permitted to accept non-hazardous waste at facility-specific acceptance threshold levels established by the Regional Water Quality Control Board (RWQCB), the permitting agency.

Additional federal and state regulations address worker exposure to safety and health hazards. The federal regulations are identified in Title 29 of the Code of Federal Regulations, and the state regulations are in CCR Title 8. The federal and California Occupational Safety and Health Administrations are the primary agencies responsible for enforcing these regulations.

B. METHOD OF EVALUATION OF IMPACTS

Identification of Hazardous Sites

Impacts on hazardous waste and/or material sites are an important consideration in the development of any major transportation improvement project. Remediation of such sites can dramatically increase the overall cost of a project. It is important to know early in the environmental analysis process where potential conflicts with these sites may occur, so that proper planning can be done to avoid these locations where possible. At this program level of analysis, available databases and information regarding the extent and nature of known hazardous materials/hazardous waste sites were reviewed. The following databases were consulted for information on potential hazardous materials risks.

- **Federal National Priorities List/Superfund:** This U.S. Environmental Protection Agency-developed database lists sites that pose an immediate public health hazard, and where an immediate response to the hazard is necessary. These listings are also found in the CERCLA database, also known as CERCLIS (Title 42 U.S.C. Chapter 103).
- **State Priority List:** Sites listed in this DTSC and RWQCB database are priority sites that were compiled from AWP and CAL-SITE databases, and sites where Preliminary Endangerment Assessments were conducted by the California Environmental Protection Agency (CEPA). The AWP database lists contaminated sites authorized for cleanup under the Bond Expenditure Plan developed by the California Department of Health Services as a site-specific expenditure plan to support appropriation of Hazardous Substance Cleanup Bond Act funds.
- **State of California Solid Waste Landfills:** The landfill sites listed in this database generally have been identified by the state as accepting solid wastes. This database includes open, closed, and inactive solid waste disposal facilities and transfer stations pursuant to the Solid Waste Management and Resource Recovery Act of 1972 and is maintained by the California Integrated Waste Management Board. The locations of the disposal facilities are primarily identified through permit applications and local enforcement agencies.

Methods of Analysis

The hazardous materials and wastes analysis for this Program EIR/EIS entailed a qualitative comparison of potential impacts on humans and the natural environment from exposure to hazardous materials or wastes that could result from proximity to or potential disturbance of sites containing these materials due to the No Project Alternative or the proposed Rail Improvement Alternative. As described above, the analysis was based on the results of a database search (Environmental Data Resources 2003) for a study area that included the potential Rail Improvements Alternative alignment options as well as proposed station locations and existing stations where expansion is proposed, as described below in Section 3.12.2. For this program-level broad analysis of potential impacts related to known priority hazards sites, the analysis was limited to hazardous materials sites and hazardous waste sites listed on the NPL, SPL, and SWLF databases. Other types of sites, such as sites with leaking underground storage tanks (LUSTs), would be considered in a subsequent phase of analysis, when site-specific analysis could be tied to more detailed alignment plans and profiles. No site-specific investigations were conducted for this analysis. Because of the large area covered, such analyses would not be cost-effective at this program-level analysis.

Potential impacts of the Rail Improvements Alternative were compared to conditions under the No Project Alternative. This assessment assumed that impacts related to hazardous materials or hazardous waste exposure could occur both during project construction and during project operation. It was based on the anticipated difference between No Project conditions and conditions under the Rail Improvements Alternative, in terms of the estimated area of the proposed improvements described in Chapter 2, Alternatives, which guided the identification of study area boundaries. This analysis focused on the number of identified NPL, SPL, and SWLF sites within the study area. The program-level comparison of alternatives in this section assesses the relative degree to which known hazardous material and waste sites could constrain the alignment options by requiring costly disposal conditions and site cleanup and remediation. In this comparative analysis, each type of listing (NPL, SPL, and SWLF) was given equal weight. The program-level analysis does not include a detailed assessment of the nature or extent of any hazardous materials or wastes that may be present at identified sites, or the degree or specific nature of potential impacts under the various alignment options. The analysis and identification of potential hazards within the study area of alignment options is useful in comparing the options and in identifying areas where avoidance may be possible in subsequent project-level review.

3.9.2 Affected Environment

A. STUDY AREA DEFINED

The Rail Improvements Alternative would result in substantial improvements to existing rail infrastructure, within or adjacent to existing rights of way, in addition to the No Project transportation improvements. Therefore, the study area for the presence of hazardous materials and wastes includes existing transportation corridors, new rail corridors, and the areas where passenger stations are being considered or expanded. The study area consisted of a 500 ft-wide (152 m-wide) (250 ft [76 m] on either side of the centerline) corridor along each alignment option identified for the Rail Improvement Alternative, and a 250-ft (76-m) radius around each station facility. The study area boundaries were based on the distance within which a hazardous material or waste site could impact the possible location of a rail improvement.

B. HAZARDOUS MATERIALS AND WASTE SITES

Two hazardous materials/hazardous waste sites were identified within the study area through the database search. One NPL/Superfund site, the El Toro Marine Corps Air Station, was identified in the northern limits of the City of Irvine, within the study area of the Fullerton Station to Irvine Station rail segment and within the study area of the Irvine Station. One solid waste landfill was identified south of Highway 52 in the Rose Canyon area, within the study area of the Highway 52 to Santa Fe Depot rail segment. These two sites are relatively minor in extent and could be effectively mitigated through typical design and construction practices.

Additional information on the results of the database search is provided in the hazardous materials and wastes technical evaluation (HDR, 2003).

3.9.3 Environmental Consequences and Comparison of Alternatives

The potential severity of impacts from hazardous material or waste releases on the construction, operations, and maintenance of the proposed alignment options would depend on two factors: the nature and severity of contamination, and the construction and operations/maintenance activities that are likely to occur near the sites. The sites that pose the greatest concern are those with soil or groundwater contamination within or adjacent to the right-of-way, and those with groundwater contamination near areas where excavation down to groundwater would be necessary. For example, dewatering during excavation, trenching, or tunneling could alter local subsurface hydraulic gradients and draw groundwater contamination into excavated areas, trenches, or tunnels. In addition, fuel or chemical vapors could move through the vadose zone[1] to excavated areas (during construction), or to underground structures associated with the rail line such as vaults and manholes (during project operation).

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The description of existing conditions in the study area is based on the known hazardous materials sites in the vicinity of the transportation infrastructure that exists in 2003. The No Project Alternative would incorporate local, state, and interstate transportation system improvements designated in existing plans and programs. This analysis assumed that no additional hazardous material or waste impacts would occur beyond those already addressed or those that would be addressed in the environmental documents for those improvement projects, and that any such impacts would largely be mitigated as part of those projects.

For the purpose of this analysis, existing hazardous materials sites and hazardous waste sites identified in the available databases were treated as the baseline for comparison. While the future conditions for the No Project Alternative may result in some additional hazardous materials or waste impacts, they cannot be predicted or estimated for purposes of this program-level analysis. Similarly, it can be presumed that between now and the year 2020 some of the existing hazardous waste sites would be cleaned up or remediated as part of CEPA and RWQCB efforts.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

As described above, the No Project Alternative was used as a proxy for the baseline 2020 condition; the impact from any improvements associated with the Rail Improvements Alternative would be in addition to the impacts from the 2020 No Project Alternative.

The Rail Improvements Alternative study area contains only two hazardous materials/ wastes sites, described below.

- **Superfund Sites:** One NPL/Superfund site, the El Toro Marine Corps Air Station, was identified within the study area. This site is located in the City of Irvine between Union Station and Irvine Station via the LOSSAN corridor alignment. This site could potentially affect the Fullerton Station to Irvine Station double tracking design options, either at-grade double tracking or double tracking in a trench. In addition, this NPL site has the potential to affect construction and operation at the Irvine Station, where proposed improvements include bypass tracks and additional parking.
- **Solid Waste Landfills:** One solid waste landfill was identified within the study area. The Rose Canyon Landfill is located in San Diego County (Highway 52 to Santa Fe Depot segment), south of Highway 52. The curve realignment and double-tracking option proposed in this segment could be affected. This landfill would not affect existing or proposed stations in the study area.

1 The vadose zone comprises the region between the land surface and underlying groundwater aquifers and is the geologic zone through which pollutants and contaminants travel prior to entering groundwater (INEEL National Vadose Zone Project, 2002).

Due to the complexity of hazardous materials/wastes sites, it was not possible to assign levels of severity of impacts of these sites without information addressing nature and extent of contamination and precise locations and boundaries of contamination zones. However, the presence of identified hazardous materials and hazardous waste sites along various alignment options indicates a potential need for cleanup or remediation of those sites. The extent of cleanup or remediation would translate into additional costs for construction, which could affect the practicality or feasibility of an alignment option.

As described above, this analysis was limited to searches of standard databases listing known sites and did not incorporate information on other smaller sites that could contribute to risk on a local basis and would be studied at the project-specific level, if the proposed Rail Improvements Alternative is pursued. In addition, because neither site-specific investigations nor onsite fieldwork was performed, little or no information is available about the nature and severity of contamination at the sites identified, or the schedule or program for cleanup, if any, so the information in this section represents a "site-count" approximation and may not fully divulge potential risk levels. Finally, all of the Rail Improvements Alternative alignment options would be within or adjacent to existing rights-of-way, and these alignments have a land use history under which additional unknown contamination (e.g., spills or accidental releases) would be a possibility. Consequently, although no unavoidable hazardous materials and hazardous waste impacts are expected for any of the alignment options, hazardous materials and hazardous waste information available at the program level is not sufficient to distinguish between alignment options.

3.9.4 Mitigation Strategies

Mitigation for impacts related to hazardous materials and/or hazardous wastes depends on detailed site-specific investigations (environmental site assessments) that would be performed at the project level of analysis. Mitigation strategies could include realignment of one or more Rail Improvements Alternative options or relocation of proposed stations to avoid an identified site, and remediation of identified hazardous material/waste contamination.

3.9.5 Subsequent Analysis

Specific studies that would be required for project-level environmental documentation include environmental site assessments, which would study the identified hazardous materials and hazardous waste sites in more detail to evaluate the nature and level of contamination and allow thorough analysis of potential impacts in accordance with applicable regulatory requirements. Tasks to be performed as part of the project-level environmental site assessment would be expected to include the following:

- Environmental database search. This would include additional databases (e.g., Cortese list, LUST list, other sites, etc.).
- Review of historical land use for all alignment options or corridor alternatives carried forward for detailed analysis.
- Site reconnaissance.
- Review of agency records and agency consultation.
- Data analysis and report preparation.

3.10 CULTURAL AND PALEONTOLOGICAL RESOURCES

Cultural resources include prehistoric archaeological sites, historic archaeological sites, traditional cultural properties, and historic structures. *Paleontological resources* refer to resources in the fossil record, such as prehistoric remains and other evidence of past life. This section discusses the applicable federal and state laws and regulations that protect cultural and paleontological resources, including Section 106 of the National Historic Preservation Act and California Public Resources Code Sections 5024.1 and 21084.1, and assesses the potential for the proposed Rail Improvements Alternative to have impacts on these resources.

3.10.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS AND GUIDANCE REGARDING SIGNIFICANCE OF IMPACTS

<u>Cultural Resources</u>

The National Historic Preservation Act (NHPA) (16 U.S.C. § 470 et seq.) established a national program to preserve the country's historical and cultural resources. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on historic properties and provide the President's Advisory Council on Historic Preservation an opportunity to comment on a proposed action before it is implemented. Guidelines for implementing the Section 106 process are provided in 36 C.F.R. Part 800. Under both state and federal guidelines for cultural resources, impacts are considered potentially significant if the resource being impacted has been determined historically significant or potentially significant. Under state law, projects that would cause a substantial adverse change in the historical significance of a historical resource are considered projects that may have a significant effect on the environment for CEQA purposes.

Under federal regulations implementing NHPA Section 106 (36 C.F.R. § 800.4), significant cultural resources are those that are eligible for listing in the National Register of Historic Places (NRHP). The NRHP eligibility criteria (36 C.F.R. § 60.4) state that the quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, association, and that meet the following criteria.

- The resource is associated with events that have made a significant contribution to the broad patterns of our history.
- The resource is associated with the lives of persons significant in our past.
- The resource embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction.
- The resource has yielded, or may be likely to yield, information important to prehistory or history.
- The resource is over 50 years old, unless it is exceptionally important.

Under CEQA, significant cultural resources are called *historical resources* whether they are of historic or prehistoric age. *Historical resources* are resources that are listed or eligible for listing in the California Register of Historical Resources (CRHR) or that are listed in the historical register of a local jurisdiction (county or city). Sites in California that are listed in the NRHP are also listed in the CRHR (P.R.C. § 5024.1). Generally, a resource should be considered by a lead agency to be historically significant if the resource has integrity and meets one of the following criteria for CRHR listing (CEQA Guidelines § 15064.5[a][3]).

- The resource is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage and/or with the lives of persons important in California's past.
- The resource embodies the distinctive characteristics of a type, period, region, or method of construction; represents the work of an important creative individual; or possesses high artistic values.
- The resource has yielded, or may be likely to yield, information important in prehistory or history.

The NRHP and CRHR criteria are almost identical. Any resource determined eligible for the NRHP is also automatically eligible for the CRHR. However, the treatment of historical resources under CEQA and in the CRHR is more inclusive in that resources listed in local historical registers may be included.

Impacts on NRHP-eligible resources are adverse when "an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 C.F.R. § 800.5[1]). Examples of adverse effects include physical destruction or damage to all or part of the property; alteration that is not consistent with the Secretary of the Interior's standards for the treatment of historic properties; removal of the property from its historic location; change in the type of use or of the physical characteristics of the setting; introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features; and neglect resulting in deterioration (36 C.F.R. § 800.5[2]). Historic properties include prehistoric archaeological sites. Archaeological sites are usually adversely affected only by physical destruction or damage, whereas all of the examples above can apply to historic buildings and structures.

Impacts on CRHR-listed and -eligible resources and resources listed in local historical registers constitute a significant effect on the environment (significant impacts that must be disclosed in a CEQA environmental document) if the project may cause a substantial adverse change in the significance of a historical resource. (P.R.C. § 21084.1). *Substantial adverse change in the significance of a historical resource* refers to "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that [its] significance … would be materially impaired" (CEQA Guidelines § 15064.5[b][1]). *Material impairment* means demolition of the resource, or alteration of the physical characteristics that make the resource eligible for listing such that it would no longer be eligible for the CRHR or a local historical register (CEQA Guidelines § 15064.5[b][2]).

Paleontological Resources

The following United States statutes incorporate provisions for the protection of paleontological resources.

- Federal Antiquities Act of 1906 (16 U.S.C. § 431 et seq.): Establishes national monuments and reservation of lands that have historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. Section 433 prohibits appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity on federal land.

- National Environmental Policy Act of 1969 (P.L. 91–190, 83 Stat. 852, 42 U.S.C. §§ 4321–4327): Mandates policies to "preserve important historic, cultural and natural aspects of our national heritage" (§ 101.b4).

In California, fossil resources are considered a limited, nonrenewable, highly sensitive scientific resource. The following state statutes incorporate provisions for the protection of paleontological resources.

- California Environmental Quality Act (P.R.C. § 21000 et seq.): Requires public agencies and private interests to identify the potential adverse impacts and/or environmental consequences of their proposed project(s) to any object or site that is historically or archaeologically significant or significant in the cultural or scientific annals of California (P.R.C. § 5020.1). Under CEQA, archaeological resources are presumed nonunique unless they meet the definition of "unique archaeological resources" (P.R.C. § 21083.2[g]). Under CEQA, an impact on a nonunique archaeological resource is not considered a significant environmental impact. An EIR need not discuss nonunique archaeological resources.

- CEQA Guidelines (14 C.C.R. § 15064.5 [a][3]): Provides that a lead agency may find that "any object, building, structure, site, area, place, record, or manuscript" is historically significant or significant in the "cultural annals of California." The section also provides that, generally, a resource may be considered historically significant if it has yielded or may be likely to yield information important in prehistory. Paleontological resources fall within this broad category and are included in the CEQA checklist under *Cultural Resources*.

- Public Resources Code Section 5097.5: Prohibits excavation or removal of any "vertebrate paleontological site ... or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands." *Public* lands include lands owned by or under the jurisdiction of the State of California or any city, county, district, authority, or public corporation, or any agency thereof. This section provides that any unauthorized disturbance or removal of paleontologic, archaeologic, and/or historic materials or sites located on public lands, which violates the section, is a misdemeanor.

- Public Resources Code Section 30244: Requires reasonable mitigation of adverse impacts on paleontological resources resulting from development on public land in the Coastal Zone, as defined in Public Resources Code Section 30103.

B. METHOD OF EVALUATION OF IMPACTS

Archaeological Sites and Traditional Cultural Properties

In connection with the statewide High-Speed Rail Program EIR/EIS (as described in Chapter 2, *Alternatives*), the FRA and the California High-Speed Rail Authority initiated consultation[1] with the State Historic Preservation Office (SHPO) under Section 106 of the NHPA in November 2002 with a letter (Appendix 3.10-A) that proposed a phased identification effort for historic properties, as provided for in 36 C.F.R. Section 800.4 (b)(2), and requested the SHPO to designate an appropriate area of potential effect (APE) for the records search and analysis for this Program EIR/EIS. The SHPO was also consulted about the method of evaluation for this Program EIR/EIS. The FRA and the Authority also initiated consultation[2] with the Native American Heritage Commission for a search of their Sacred Lands file and lists of Native American contacts, as required by 36 C.F.R. Section 800.4(a)(4). The contacts were sent letters providing information about the proposed project alternatives and requesting information about any traditional cultural properties that could be affected by the project (36 C.F.R. § 800.4[a][4]).

In addition, information from records searches was obtained from the appropriate California Historical Resources Information System (CHRIS) Information Centers. The records searches identified the general locations of archaeological sites in the APE. The number of archaeological sites within the APE for each alignment option was tabulated and used as an indicator of potential sensitivity for the comparison of the relative degree of potential impacts or effects for each alignment. For this program-level analysis, individual archaeological sites were not evaluated for eligibility. Instead, the archaeological sites identified as a result of the records searches were considered potentially eligible for listing in the CRHR or the NRHP, and the number of archaeological sites per linear mile identified in the APE was used as one indicator of the relative degree of potential impacts on cultural resources from construction or operation of the Rail Improvements Alternative. Impacts to NRHP-eligible archaeological resources include physical destruction or damage. The total number of archaeological sites in the APE for the corridor was divided by the total length of the corridor being evaluated to arrive at an average number of sites (or proportion of sites) per mile.

The cultural resource specialist's knowledge and background of regional prehistory supplemented the records search results. For example, if the cultural resource specialist has previous experience that numerous sites have been identified along a particular river drainage in the region, but the records search did not yield formally recorded sites in CHRIS within the APE for a particular alignment option, the cultural resource specialist documented the additional information and, based on it, increased the rating for that corridor. The proposed type of construction was also taken into account, based on relative differences in surface or near-surface disturbance. For alignment options that include tunneling, it is likely that the tunneled portions would avoid most impacts to cultural resources due to the depth of the tunneling. At-grade options would disturb the

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[1] The initiation of consultation with the SHPO was done in the context of the statewide high-speed rail program described in Chapter 2. The designation of an APE for the project applied to the LOSSAN region as well as the other regions involved in the statewide study. A separate consultation process would be completed by the Department for the project-level assessment stage.

[2] The consultation with the Native American Heritage Commission was also undertaken in the context of the statewide high-speed rail program, and was utilized in development of this LOSSAN Rail Improvements Program EIR/EIS. Continued consultation would be undertaken by the Department during the project-level assessment stage.

ground surface, and trenching would be more likely than at-grade work to disturb sub-surface cultural resources.

Traditional cultural properties were assessed on a presence/absence basis using record searches of CHRIS repositories for each alignment option. Because no traditional cultural properties were identified in the APE of any of the alignment options, these resources did not affect rankings of alignments in this program-level assessment.

Historic Structures

Structures from the historic period consist of houses, outbuildings, stores, offices, factories, barns, corrals, mines, dams, bridges, roads, and other facilities that served residential, commercial, industrial, agricultural, transportation, and other functions during the historic period (more than 50 years ago). Specific structures from the historic period were not identified for this program-level analysis. Instead, the percentage, based on linear miles, of each alignment option that passed through areas that originally developed in specific, predefined historical time periods (before 1900, 1900 to 1929, and 1930 to 1958) was determined from historical maps, aerial photographs, and local planning documents of the history of the region. The percentages were used as indicators, along with known National Register Historic Districts and listed eligible properties, of the potential for a alignment to impact potentially eligible structures from the historical time periods

Paleontological Resources

Paleontological resources determined to be significant are fossils or assemblages of fossils that are unique, unusual, rare, uncommon, and diagnostically or stratigraphically (layers of the earths surface) important, and/or those that add to an existing body of knowledge in specific areas—stratigraphically, taxonomically, and/or regionally.

Literature research and institutional records searches or geologic maps and geographic data from the University of California Museum of Paleontology in Berkeley have resulted in the designation of areas within the APE as having *high*, *low*, or *undetermined* paleontologic sensitivity, as follows.

- High: Sedimentary units with a high potential for containing significant nonrenewable paleontological resources. In these cases the sedimentary rock unit contains a high density of recorded vertebrate fossil sites, has produced vertebrate fossil remains within the study area and/or vicinity, and is very likely to yield additional remains within the study area.
- Low: The rock unit contains no or very low density of recorded resource localities, has produced little or no fossil remains within the study area and/or vicinity, and is not likely to yield any remains within the study area.
- Undetermined: The rock unit has had limited exposure(s) in the study area and has been little studied, and there are no known recorded paleontological resource localities. However, in other areas, the same or a similar rock unit contains sufficient paleontological resource localities to suggest that exposures to disturbance of the unit within the right-of-way have potential to yield fossil remains.

The number of rock units (formations) having high paleontologic sensitivity and the number of paleontological resource localities recorded within the study area were assessed to provide an accurate interpretation of the overall ranking of high, low, or undetermined potential to impact significant nonrenewable paleontological resources. This evaluation was reached using both the numbers of formations and localities and incorporating professional assessments regarding the significance of recovered resources from exposed rock units and the likelihood of these rock units to contain additional paleontological resources.

3.10.2 Affected Environment

A. STUDY AREA DEFINED: AREA OF POTENTIAL EFFECT

The study area for cultural resources is the APE that was defined in consultation with the SHPO. At this program level of analysis, information for the APE about the locations of archaeological sites was obtained from the Information Centers of the CHRIS, administered by the California Department of Parks and Recreation. The CHRIS database includes all resources listed in the CRHR; all resources in California listed in or eligible for listing in the NRHP; and traditional cultural properties, including some Native American traditional cultural sites, identified through consultation with the California Department of Parks and Recreation (Section 106 of NHPA), the SHPO (P.R.C. § 5042 et seq.) or the Native American Heritage Commission.

Based on consultation with the SHPO, the APE for cultural resources for the proposed Rail Improvements Alternative is as follows.

- 500 ft (152 m) on each side of the centerline of proposed new rail routes where additional right-of-way could be needed.
- 100 ft (30 m) on each side of the centerline for routes along existing highways and railroads where very little additional right-of-way would be needed.
- 100 ft (30 m) feet around station locations.

The study area for paleontological resources under the Rail Improvements Alternative is 100 ft (30 m) on each side of the centerline of proposed alignment options (including station locations), in both non-urban and urban areas. The study area for paleontological resources is limited to the area that would potentially be disturbed by earthwork construction activities.

B. CULTURAL RESOURCE CATEGORIES

The following topics are covered in this section

- Prehistoric archaeological sites
- Historic archaeological sites
- Traditional cultural properties
- Historic structures
- Paleontological resources

The following paragraphs briefly describe each type of resource.

Prehistoric Archaeological Sites

Prehistoric archaeological sites in California are places where Native Americans lived or carried out activities during the prehistoric period before 1769 AD. Prehistoric sites contain artifacts and subsistence remains, and they may contain human burials. Artifacts are objects made by people and include tools (projectile points, scrapers, and grinding implements, for example), waste products from making flaked stone tools (debitage), and nonutilitarian artifacts (beads, ornaments, ceremonial items, and rock art). Subsistence remains include the inedible portions of foods, such as animal bone and shell, and edible parts that were lost and not consumed, such as charred seeds.

Historic Archaeological Sites

Historic archaeological sites in California are places where human activities were carried out during the historic period between 1769 AD and 50 years ago. Some of these sites may be the result of Native American activities during the historic period, but most are the result of Spanish, Mexican, or Anglo-American activities. Most historic archaeological sites are places where houses formerly existed and contain ceramic, metal, and glass refuse resulting from the transport, preparation, and consumption of food. Such sites can also contain house foundations and structural remnants, such as windowpane glass, lumber, and nails. Historical archaeological sites can also be nonresidential, resulting from ranching, farming, industrial, and other activities.

Traditional Cultural Properties

Traditional cultural properties are places associated with the cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community. Examples include locations "associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world" and locations "where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice" (Parker and King 1990). Traditional cultural properties are identified by consulting with Native American groups that have a history of using an area, as well as the Native American Heritage Commission, the Sacred Lands File, and tribal representatives.

Historic Structures

Historic structures consist of houses, outbuildings, stores, offices, factories, barns, corrals, mines, dams, bridges, roads, and other facilities that served residential, commercial, industrial, agricultural, transportation, and other functions during historic periods (more than 50 years ago). The historic periods correspond to the principal architectural styles seen in California: before 1900 (pre-Victorian and Victorian), 1900 to 1929 (Craftsman/bungalow), and 1930 to 1958 (commercial modern and residential ranch style).

Paleontological Resources

Paleontological resources are the fossilized remains of animals and plants. They are typically found in sedimentary rock units, and they provide information about the evolution of life on earth over the past 500 million years or more.

C. CULTURAL RESOURCES IN THE STUDY AREA

The California Historical Resources Information System (CHRIS) information centers were a primary source of data for the identification of historic properties and archaeological resources in the cultural resources study area.

Archaeological Resources

As described above, information on the numbers, kinds, and locations of archaeological sites for this Program EIR/EIS was obtained from CHRIS. For the most part, the data from the CHRIS provide archaeological site information only for areas that have been previously surveyed by archaeologists. No archaeological field surveys were conducted for this Program EIR/EIS. However, surveys would be a part of the next stage of environmental review in the project-level evaluation (see Section 3.10.5).

The LOSSAN region includes the a portion of the Los Angeles basin and the coastal areas of southern California between Orange County and San Diego, generally following the existing LOSSAN rail corridor. The Milling Stone Period along the southern California coast (about 5000 BC to 1000 BC or from 7,000 to 3,000 years ago) was characterized by smaller, more mobile groups compared to later periods. The period from 1000 BC to AD 750 (3,000 years ago to 1,350 years ago) is known archaeologically as the Intermediate Period. More specifically, in the Los Angeles Basin, perhaps the earliest evidence of human occupation was recovered from the tar pits of Rancho La Brea. In 1914, the partial skeleton of a young woman was discovered in association with a mano. In the 1970s, a collagen sample from the skeleton was dated at circa 9,000 years old. In addition, projectile points similar to those found in the desert dating from 10,000 to 7,000 years ago, as well as crescent-shaped flaked tools, called crescentics, have been recovered from bluffs near Ballona Lagoon. The presence of these point types along the coast suggests connections between what is now the Los Angeles area and the cultures of the southeastern California desert regions during this early period.

The cultural elements of Orange County reflect both unique cultural traits and a mixture of regional influences. The Paleo-Coastal Period is best seen in Orange County at a site located on the Pacific Coast where dates show evidence of habitation by 8,000 years ago. During the Milling Stone Period, coastal lagoons supported large populations; local variations have been grouped as the La Jolla Complex[3] and the Encinitas Tradition. The Encinitas Tradition reflects coastal adaptations and is seen from San Diego to Santa Barbara. Environmental conditions between 2000 and 1000 BC (the Intermediate Period) forced a shift of habitation locations away from the coast with more emphasis on bays and inland areas, as is also evidenced in San Diego County. Late Period sites, from 1,350 years ago, reflect an increase in population density and a shift to more sedentary habitation. In coastal Orange County, the Irvine Complex reflects a coastally oriented adaptation; the San Luis Rey Complex reflects an inland-oriented lifeway.

[3] *Complex* refers to a group or association of artifacts and subsistence remains that are characteristic of a specific period of time and geographic area.

The prehistory of coastal San Diego County begins with the San Dieguito Complex. The San Dieguito Complex was originally thought to represent big game hunters who moved to the San Diego County coastal area from the Great Basin during Early Holocene time (8,000 to 10,000 years before present (BP) or 10,000–5,000 BC). This movement occurred when warmer, drier conditions resulted in desiccation of the pluvial lakes in the Great Basin. Although it was thought that big game hunting continued after these people arrived on the coast during Early Holocene time, more recent investigations at Early Holocene sites closer to the coast has shown that a wide range of plant foods, along with small and medium-sized terrestrial mammals, fish, and shellfish, were being exploited in these sites. Population size was likely low, with relatively little competition for resources. Therefore, small groups probably moved throughout the coastal area and the area inland of the coastal hills and mountains to wherever the best resources were available at the time.

Archaeological sites occupied between 3,000 and 8,000 years ago on the San Diego County coast belong to the La Jolla Complex. Most La Jolla Complex sites are located around the coastal lagoons, which began filling with seawater at the beginning of this period because of a rise in the sea level, as the ice caps melted at the end of the last ice age. Most sites around lagoons on the San Diego County coast were abandoned about 3,000 years ago. However, sites around Peñasquitos Lagoon and San Diego Bay continued to be occupied because these two southern bay/estuary systems did not fill with sediment. Still, in general, there are few sites in the coastal region that date to the period between 1,300 and 3,000 BP. Little is known about settlement and subsistence during this period of San Diego County prehistory.

Prehistoric archaeological sites types commonly found along the rail improvement alignment options in the LOSSAN region include lithic scatters[4], milling stations[5], shell middens[6] and quarries[7]. Less common are habitation or village sites, which can include midden, rock features and in some cases human burials.

The Late Period (200 to 1,300 BP in this area) is characterized by a more sedentary settlement system and a more intensive use of available resources. The large villages, occupied almost year-round, that were observed by the Spanish in 1769 AD developed during this period.

The LOSSAN region traverses the territories of several Native American tribes. The Los Angeles Basin was part of territory occupied by the Tongva Native American groups (renamed Gabrielinos by early explorers, missionaries, and settlers) when the Spanish arrived in AD 1769. Tongva settlement and subsistence systems may extend back in time to the beginning of the Late Prehistoric Period about AD 750. The Juaneño, usually considered a sub-tribe of the Gabrielino, occupied a territory immediately to the south of the Gabrielino proper, and shared many of the same social and religious structures. The Luiseño, like the Gabrielino, were a Shoshonean people. Luiseño tribal territory is

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4 *Lithic scatter* refers to a site containing general utility implements such as projectile points, bifaces, expedient flake tools, and debitage.

5 *Milling station* is a location with bedrock mortars or milling slicks, used to process floral, and perhaps faunal, resources.

6 *Midden* refers to a mound or deposit containing shells, animal bones, and other refuse that indicates the site of a human settlement.

7 A quarry is a source of geologic material, such as obsidian, quartzite, chert, or basalt, used by Native Americans for manufacture, as well as debitage or other debris from this manufacture.

located to the south of the Gabrielino, extending from the ocean, skirting around the Juaneño territory, north to Santiago Peak and south to Palomar Mountain. San Diego County is the traditional territory occupied by the Kumeyaay or Diegueño people. This Native American tribe is a Yuman-speaking group of the Hokan stock.

Historic Structures

Originally California was a Spanish colony. Spanish settlement began in 1769 with the Portola Expedition. As a result of this expedition, 21 missions and several presidios (forts) and towns were established near the coast between San Diego and Sonoma. One of the missions, San Juan Capistrano, is located near the rail improvement alignment options through San Juan Capistrano. (See Chapter 2, *Alternatives*, for maps of the alignment options.)

During their occupation of the area, the Spanish made a few land grants to retired soldiers. In addition, after Mexico became independent from Spain in 1821, the Mexican government dissolved the mission system in 1834 and began granting the former mission lands to Mexican citizens and others for use as cattle ranches. Many of the grantees built adobe houses on their land grants, some of which survive today. The few towns and presidios founded by the Spanish, including Los Angeles (town) and San Diego (presidio), continued to grow slowly. As a result of the Treaty of Guadalupe-Hidalgo, California became part of the United States in 1848.

Southern California remained largely a cattle ranching area until the arrival of the Southern Pacific Railroad from San Francisco via the San Joaquin Valley in 1876, and from Yuma, Arizona, and points east in 1878. The number of immigrants to southern California dramatically increased in the late 1880s because of cheap railroad fares that resulted from a rate war between the Southern Pacific Railroad and the Atchison, Topeka, and Santa Fe (AT&SF) Railroad. The AT&SF Railroad arrived in southern California in 1886 and extended to Richmond in the Bay Area in 1900. One result of the immigration of large numbers of people to California in the 1880s was the development of new towns along the railroad routes and the construction of houses in the Victorian style in these towns and in the previously established urban centers, including Los Angeles.

Continued urban expansion in conjunction with the first widespread use of automobiles resulted in construction of numerous houses in the Craftsman bungalow style farther from the original urban cores during the 1910s and 1920s. The Spanish Colonial Revival style also became popular in the 1920s and continued into the 1930s. Use of automobiles led to linear commercial strips along arterials and shopping centers at major intersections. These buildings, as well as office buildings, were often built in zigzag moderne (art deco) and streamline moderne styles in the 1930s and 1940s. Residences were built in ranch style with an open plan (combined living and dining rooms) beginning in the 1940s. In the 1950s, suburbs expanded with the advent of builders' tract homes, mostly in ranch style, where a limited number of plans were standardized and repeated throughout the tract.

Historic structures in the LOSSAN region are primarily 20th-century (1900 to 1929 and 1930 to 1958) residential, commercial, and industrial structures located within cities. Large tracts of residential houses are most common, with industrial and commercial structures largely confined to existing railroad rights-of-way in the Los Angeles and

San Diego areas. However, many of the medium-sized cities of the region, such as Anaheim, Fullerton, and San Clemente, began as small towns in the late 19th or early 20th century. The historic core areas of cities in this region commonly preserve some buildings from this time period.

Structures dating to the period before 1900 are rare. As in other parts of southern California, structures from this time period were sparse in much of this region and were built in perishable vernacular (wood frame) styles. However, there are notable exceptions, especially the Spanish and Mexican Period development in downtown San Juan Capistrano (1769 to 1848) around Mission San Juan Capistrano (founded in 1776) and the Hispanic to American Transition Period (1848 to 1870) development along the waterfront of San Diego, and Old Town San Diego. In the largest cities of the region, Los Angeles and San Diego, large sections of houses and commercial structures built before 1900 have been replaced by subsequent development.

Paleontological Resources

California's rich geologic record and complex geologic history has resulted in exposure of many rock units with high paleontologic sensitivity at the surface. The fossil record in California is exceptionally prolific; abundant fossils representing a diverse range of organisms have been recovered from rocks as old as 1 billion years to as recent as 11,000 years. These fossils have provided key data for charting the course of the evolution and extinction of various types of life on the planet, both locally and globally, as well as for determining paleoenvironmental conditions, sequences and timing of sedimentary deposition, and other details of geologic history.

Formations in the LOSSAN region with the potential to yield fossils are summarized below. More detailed information is provided in the LOSSAN technical report for paleontological resources.

- The Ardath Shale and Scripps Formation along the rail segments from Highway 52 to San Diego, with shark, ray, bony fish, marine microorganism and macroinvertebrate, rhinoceros, artiodactyl, brontothere, uintathere, crocodile, turtle, as well as wood fossils.
- The Delmar Formation in Del Mar and between the I-5/805 Spilt and Highway 52, with estuarine vertebrate and invertebrate, aquatic reptile, and rhinoceros fossils.
- The Torrey Sandstone from Encinitas to Solana Beach and Del Mar, with plant and marine invertebrate fossils.
- The San Mateo Formation at Camp Pendleton, with horse, camel, peccary, llama, sea cow, fur seal, walrus, sea otter, sea bird, whale, dolphin, shark, ray, bony fish, and marine invertebrate fossils.
- The Capistrano Formation from Irvine to San Juan Capistrano, Dana Point, San Clemente, Camp Pendleton, Oceanside, and Carlsbad, with whale, walrus, sea cow, fur seal, sea bird, shark, ray, bony fish, and kelp fossils.
- The Niguel Formation from Irvine to San Juan Capistrano, with marine mollusk and marine vertebrate fossils.

- The San Diego Formation along Highway 52 to San Diego, with shark, ray, bony fish, marine invertebrate, sea bird, walrus, fur seal, cow, whale, dolphin, terrestrial mammal, wood, and leaf fossils.
- The Lindavista Formation along I-5/I-805, with marine invertebrate, shark, and whale fossils.
- The Bay Point Formation along Highway 52 to San Diego, with shark, ray, bony fish, and mollusk fossils.
- Unnamed marine terrace deposits from Camp Pendleton through Encinitas and Solana Beach to the Santa Fe Depot in San Diego, with marine invertebrate, shark, ray, bony fish, and terrestrial mammal fossils.

3.10.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The No Project Alternative is composed of transportation projects other than the proposed Rail Improvements that are projected to be completed between the time of this EIR/EIS and 2020, including local, state, and interstate transportation system improvements designated in existing plans and programs. No additional impacts on cultural resources would occur under No Project beyond those addressed in environmental documents for those projects.

Because it was not realistically feasible for this Program EIR/EIS to identify or quantify all the impacts on or mitigation activities for cultural resources associated with all of the projects considered as part of the No Project Alternative, the existing condition was used to represent the No Project conditions. It is possible that other transportation projects (not including the Rail Improvements Alternative) may impact some existing cultural resources by 2020, and that these changes to the baseline would be described and quantified in subsequent environmental analysis and reflected in future database information. This Program EIR/EIS addresses the potential effect on cultural resources as they exist at present and uses this information to compare the potential for impacts from the alignment options of the Rail Improvements Alternative.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

The Rail Improvements Alternative would potentially impact archaeological resources and historic structures as a result of construction (short term impacts), including grading, cutting, tunneling, and erecting pylons for elevated track, as well as station construction or expansion. Overall, the Rail Improvements Alternative is ranked as high in terms of the presence of archaeological resources, historic structures, and paleontological resources that could potentially be impacted. This Alternative’s potential impact on historic structures is evaluated as higher than the No Project Alternative because the Rail Improvements Alternative would use or be adjacent to the existing LOSSAN rail corridor which was developed during historic periods and tends to be surrounded by historic structures. Cumulative impacts are possible because the combined impacts from the Rail Improvements Alternative, projects anticipated or planned for under No Project, and other residential and commercial development projects in the study area can be expected to be greater than from the Rail Improvements Alternative alone.

Potential impacts to historic properties during operation of the Rail Improvements Alternative would be related to noise or visual impacts, discussed in Sections 3.4 and 3.7, respectively, of this EIR/EIS, although potential impacts are limited by the long history of rail noise and visual presence in the LOSSAN corridor.

The Rail Improvements Alternative would have greater potential impacts on cultural resources than the No Project Alternative. Although many of the potential impacts could be avoided or minimized through design refinements or alignment, it is not always feasible to avoid impacts to cultural resources, and mitigation measures would need to be identified and evaluated to address these situations for specific projects.

Table 3.10-1 summarizes the comparison of potential impacts on cultural and paleontological resources for each of the alignment options. Archaeological sites are depicted on Table 3.10-1 as an average number of sites per mile, derived by dividing the number of known sites within each alignment option in a rail segment by the linear miles in that segment. This was done in order to provide a common basis of comparison among alignment options regardless of the differences in alignment or rail segment lengths.

The table depicts average numbers of archaeological sites and relative ratings for potential impacts on historic and paleontological resources from each alignment option without evaluating the potential significance of adverse effects at this programmatic level of review. This information is based on available data and CHRIS records information, not on field studies. The table does not show any traditional cultural properties because none have been identified to date within the APE by the Native American Heritage Commission or any Native American tribe.

Table 3.10-1
Summary of Potential Impacts to Cultural and Paleontological Resources

Rail Improvement Alignment Option	Known Archaeological Sites Per Mile	Potential for Historic Structures (H, M, L)	Percent of Alignment Developed during Historic Periods (prior to 1958)	Paleontological Sensitivity Rating (H, M, L)
Union Station To Fullerton Station – 4th Main Track	0.29	High	79%	Low
Fullerton Station To Irvine Station--Double Tracking				
AT-GRADE between Orange and Santa Ana	0.75	High	96%	High
TRENCH between Orange and Santa Ana	0.75	High	96%	High
Stations Fullerton	0	Low		High
Anaheim	0	Low		High
Santa Ana	0	Medium		High
Irvine	0	Low		High

Table 3.10-1
Summary of Potential Impacts to Cultural and Paleontological Resources (continued)

Rail Improvement Alignment Option	Known Archaeological Sites Per Mile	Potential for Historic Structures (H, M, L)	Percent of Alignment Developed during Historic Periods (prior to 1958)	Paleontological Sensitivity Rating (H, M, L)
San Juan Capistrano Double Tracking				
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	1.6	Low	37%	High
AT-GRADE and Cut/Cover TRENCH along east side of Trabuco Creek	0.28	High	37%	High
Stations San Juan Capistrano	0	High		High
Dana Point/San Clemente Double Tracking				
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	0.40	Low	38%	High
San Clemente - LONG TWO-SEGMENT TUNNEL	0.49	Low	38%	High
Stations San Clemente	0	Medium		High
CAMP PENDLETON At-grade Double Tracking	2.62	High	6%	High
Oceanside/Carlsbad Double Tracking				
Carlsbad - AT-GRADE; double tracking	0.61	Medium	71%	High
Carlsbad -TRENCH; double-tracking	0.61	Medium	71%	High
Stations Oceanside	0	Medium		High
Encinitas/Solana Beach Double Tracking				
Encinitas - AT-GRADE	0.57	High	65%	High
Encinitas - SHORT TRENCH	0.57	High	65%	High
Stations Solana Beach	0	Medium		High
Del Mar Double Tracking				
TUNNEL under Camino Del Mar	0.22	Medium	31%	High

Table 3.10-1
Summary of Potential Impacts to Cultural and Paleontological Resources (continued)

Rail Improvement Alignment Option	Known Archaeological Sites Per Mile	Potential for Historic Structures (H, M, L)	Percent of Alignment Developed during Historic Periods (prior to 1958)	Paleontological Sensitivity Rating (H, M, L)
TUNNEL along I-5	0.86	Low	31%	High
I-5/805 Split To Hwy 52 Double Tracking				
Miramar Hill TUNNEL	0.75	Low	27%	High
I-5 TUNNEL	0.75	Low	27%	High
Stations UTC (Only applies to Miramar Hill Tunnel)	0	Low		High
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	1.17	High	38%	High
Stations Santa Fe Depot	0	High		High

Depending on the alignment option, the number of known archaeological sites that could be affected by the Rail Improvements Alternative ranges from 100 to 118 sites. The average number of known archaeological sites per alignment mile varies from a low of 0.22 sites per mile, along the Camino del Mar tunnel option in Del Mar, to a high of 2.62 sites per mile in the Camp Pendleton rail segment. The average number of sites per mile does not provide clear differentiation between alignment options except in the San Juan Capistrano and Del Mar rail segments. However, in both of these segments, the option with the higher number of known sites per mile is a tunnel option, so most archaeological resources would be avoided due to the depth of the tunnel. Trenching would have the highest potential for impact to subsurface sites compared to either at-grade or deep-tunnel construction.

The percentage of the study area that developed during historic periods is one indication of the potential for historic structures along each of the alignment options. Historic development along the alignment options varies from a high of 96 percent in the Fullerton to Irvine segment, to a low of about 6 percent in the Camp Pendleton segment where there is very little development along the rail corridor. However, nearly all at-grade or trench alignment options have a medium to high potential for historic structures. This is due largely to the urbanized nature of the study area, and the historical development of new towns around the railroad. Tunnel segments of the proposed improvements would avoid most potential impacts to historic structures.

Paleontological sensitivity is rated as high for all rail segments south of Fullerton, and for all existing and proposed station sites south of Irvine Station. The potential for impacts to paleontological resources is approximately the same for all alignment options, although the below-grade (trench or tunnel) options have a greater potential for impacts than at-grade options. Therefore, paleontological resources do not provide a basis for differentiating between alignment options.

The following sections briefly describe potential cultural resource impacts along the alignment options, based on available information (not on field studies). At this level of analysis, the extent and types of potential impacts to actual structures and sites are not known, nor is it known whether any such impacts would meet criteria for significance under NEPA/NHPA and CEQA.

Union Station to Fullerton Station

Six archaeological sites are recorded within the APE for this segment. In this urban environment, and considering the proximity of the segment to the Rio Hondo and Los Angeles River and the possibility of buried sites, there is an unknown, but possibly high, potential for prehistoric archaeological sites.

This segment passes largely through a built environment, with structures primarily dating from the 1930 to 1958 period, but a significant number of structures dating to 1900-1929 or earlier are also present. This indicates there is a high potential to encounter previously unrecorded historic-era structures along this alignment. Proposed improvements would be built within the existing rail corridor, reducing potential for impacts to structures.

Fullerton Station to Irvine Station

Both the at-grade and trench alignment options would be within the LOSSAN rail corridor in this segment. Fifteen archaeological sites are recorded for this APE, all but one of which are at historic-era houses. The one prehistoric site is noted as being “buried.”

This segment passes through a largely built environment, with structures primarily dating from the 1930 to 1958 period, but with a significant number of structures dating to 1900–1930 also present. This indicates there is a high potential to encounter previously unrecorded historic-era structures along this alignment. Within this built environment, considering the limitations of surface survey due to urban development and the proximity of the San Gabriel and Santa Ana rivers, as well as the record of one “buried site,” the potential for unknown prehistoric and historic archaeological sites along this section is high for both the at-grade and trench option.

The trench option has a slightly higher potential than the at-grade option to encounter previously unknown prehistoric and historical archaeological sites.

San Juan Capistrano

The APE for the I-5 tunnel option encompasses eight archaeological sites. This tunnel option would be deeply underground for most of its length, and would cross relatively new neighborhoods in San Juan Capistrano and avoid the older portions of the city where it would be at-grade or transitioning to/from the tunnel. Therefore, it has a low potential to encounter previously unrecorded historical structures. However, the entire APE is highly sensitive for prehistoric, proto-historic (European contact period), and historical sites, so non-tunnel sections and construction at portal areas would have a moderate to high potential to expose previously unknown archaeological sites. Tunneling would avoid most or all potential impacts to these resources.

The APE for the at-grade/trench option along the east side of Trabuco Creek encompasses two archaeological sites, both of which are prehistoric habitation locations, and one of which may have already been destroyed. This segment runs south along creek terraces on the edges of Trabuco Creek, and crosses San Juan Creek before rejoining the existing LOSSAN right-of-way. These streamside locations are sensitive for buried cultural deposits, and the potential for prehistoric sites along this segment is high. Since this alignment passes through relatively old neighborhoods in San Juan Capistrano, this option has a medium to high potential to encounter previously unrecorded historical structures. This entire area is highly sensitive for prehistoric, proto-historic (European contact period), and historical sites, so at-grade and trenched construction would have a high potential to expose previously unknown archaeological sites.

Dana Point/San Clemente

The APE for the short tunnel option from Dana Point through San Clemente encompasses nine archaeological sites. Two of the sites within the APE are prehistoric village sites known to have burials. Because these sites are already known within the APE, and due to the proximity of the alignment to the Pacific Ocean and the mouths of San Onofre and San Mateo canyons, the non-tunnel sections of this alignment (including the at-grade Dana Point curve realignment) have a high potential to encompass previously unknown prehistoric sites.

Because the non-tunnel sections of this option pass across relatively new neighborhoods in Dana Point and San Clemente and avoids the older portions of San Clemente, this option has a low potential to encounter previously unrecorded historical structures.

The long two-segment tunnel option from Dana Point through San Clemente runs inland and proceeds along the I-5 corridor, surfacing at San Onofre State Beach. This option would not require the at-grade Dana Point Curve realignment. There are 11 known archaeological sites in this APE, two of which are prehistoric village sites known to have burials (the same two sites as noted for the short tunnel option above). There is a high potential to encompass previously unknown prehistoric sites within the APE but the majority of the segment would be in deep tunnels and would avoid most potential impacts.

Non-tunnel portions of this option would cross relatively new neighborhoods in Dana Point and San Clemente and, therefore, has a low potential to encounter previously unrecorded historical structures.

Camp Pendleton

In the Camp Pendleton rail segment, 41 archaeological sites are recorded within the APE, for an average of 2.62 sites per mile. Of these, 17 are historical, and 24 are prehistoric. The abundance of prehistoric sites within the APE is due to its proximity to the Pacific coast, various side canyons and lagoons, and the Santa Margarita and San Luis Rey rivers. In addition, Native American burials are known to have been recovered in the area. Due to the high number of sites already recorded and the proximity of the corridor to this rich coastal zone, the potential for unknown prehistoric sites is high in the APE.

Historic-era structures are few in this segment, but there are potentially historic structures in proximity to and associated with Old Highway 101, Camp Pendleton Marine Corps Base, and the ATSF (LOSDSAN) railroad. One known historic site within the APE is Las Flores Estancia, listed on the California Inventory of Historic Resources. The potential for historical structures and historical sites is high in this section of the APE.

In this rail segment, the proposed double tracking would be at-grade within the LOSSAN rail right-of-way. Confining construction to the right-of-way would reduce the potential for high impacts to cultural resources in this segment.

Oceanside To Carlsbad

The at-grade and the trench options in this segment would have the same alignment within the existing LOSSAN corridor. Six prehistoric archaeological sites are recorded within the APE. The proximity of this rail segment to the coastal environment, the limitations of surface survey due to development, and the presence of known prehistoric sites all indicate that there is a high potential for unknown prehistoric sites in this APE.

Historic development began in these coastal towns before 1900, but occurred primarily in the years between 1930 and 1958. Several buildings in Oceanside are listed as historic, and the Carlsbad Santa Fe terminal is listed on the California Inventory of Historic Resources. These facts suggest that there is a moderate to high potential for previously unrecorded historical structures in the APE for this rail segment.

The trench option includes approximately one mi (1.6 km) of trenching through downtown Carlsbad. Since sub-grade trenching increases the potential to encounter unknown archaeological sites, this option would have a somewhat higher potential for impacts to prehistoric sites than the at-grade option.

Encinitas To Solano Beach

The at-grade and short-trench options in this segment would be within the LOSSAN rail corridor along the Pacific coast. Four archaeological sites are recorded in the APE. Within this built environment, considering the limitations of surface survey due to urban development and the proximity of the corridor to the coast, and to coastal rivers and lagoons, the potential for unknown archaeological sites along this section is moderate to high.

In general, historic-era structures from 1900 to 1958 are common in this segment. The Encinitas Historic District extends across part of the APE in the center of town. These factors suggest a moderate to high potential for unrecorded historical structures.

The trench option includes approximately 1.5 mi (2.4 km) of trenching through downtown Encinitas. Sub-grade trenching would increase the potential to encounter unknown archaeological sites, compared with at-grade construction.

Del Mar

Two archaeological sites are recorded within the APE for the tunnel option under Camino Del Mar. Within this built environment, considering the proximity of the segment to the coast and San Dieguito River and Lagoon, and to known sites in the area, there is an unknown, but possibly high, potential for prehistoric archaeological sites.

The presence of many historic-era structures from the years 1900–1929 and 1930–1958 suggests that there is a moderate to high potential for previously unrecorded historical structures along this alignment.

The I-5 tunnel option would leave the LOSSAN corridor just north of Del Mar racetrack and turn inland, passing along the southern shore of San Dieguito Lagoon. It would then proceed in a tunnel under I-5. Eight archaeological sites are recorded within APE for this option. Numerous prehistoric sites are known to exist along the shores and bluffs of San Dieguito Lagoon. Due to the proximity of this option to the lagoon and coast, there is an unknown, but possibly high, potential for prehistoric archaeological sites.

This segment of the APE was mostly developed during the years 1930 to 1958; however, there are few standing structures within the APE. Therefore, this segment has a low potential for previously unrecorded historical structures.

Both options in the Del Mar area would involve deep tunnels which would avoid most potential impacts to cultural resources. However, the I-5 tunnel option would require new at-grade and aerial rail infrastructure at the south end of the San Dieguito Lagoon, so this option would have a higher potential for impacts to unknown archaeological sites than the Camino del Mar tunnel option.

I-5/805 Split To Highway 52

The APE for the Miramar Hill tunnel alignment encompasses seven recorded archaeological sites. Given the segment's proximity to Rose Canyon and the village site of Ystaagua, and because of the limitations of surface survey due to urban development in this area, the potential for unknown prehistoric sites is moderate to high.

Historic-era development in this APE is primarily recent, from the 1960s and 1970s. Therefore this option has a low potential to encompass unrecorded historical structures.

The APE for the I-5 tunnel option encompasses three archaeological sites. Due to the proximity of the segment to both Rose and Soledad canyons, and access to the coast, there is an unknown but possibly high potential for prehistoric archaeological sites. This alignment option passes through a relatively steep sided canyon with commercial, medical and educational facilities on the mesa tops, all built post-1960. This indicates that there is a low possibility to find previously unrecorded historical structures.

Both alignment options in this segment would involve deep tunneling, so most potential impacts would be avoided, and there is no discernible difference between the options relative to cultural resources.

Highway 52 To Santa Fe Depot

Ten prehistoric and two historic archaeological sites are recorded in the APE for this rail segment, where proposed improvements would include at-grade double tracking and curve realignment, trenching, and a new bridge structure. At the northern end of this segment, the village site of La Rinconda de Jamo, is adjacent to the APE, but is not recorded as extending into the APE. However, this prehistoric village could have buried components situated within the APE. Nine other prehistoric sites are recorded within this segment, indicating that there is a high potential for unknown prehistoric archaeological sites in the APE.

The south end of the rail segment passes near two historic districts, the General Dynamics buildings and the U.S. Marine Corps Recruit Depot near Lindbergh Field, before terminating at the Santa Fe Depot on the waterfront in downtown San Diego. This portion of the APE is located within 0.25 mi (0.4 km) of the historic Gaslamp Quarter, Old Town San Diego Historic District, and the Presidio, and is a prime location for early historic maritime, transportation, and trade activities, as well as for prehistoric habitation. The terminal at Santa Fe depot and the Mission Brewery are listed on the California Inventory of Historic Resources. Given that a large amount of historic-era development occurred in this area in the period 1769 to 1958, the potential for historic structures or structural remains in the proximity to downtown San Diego is high.

The majority of proposed improvements in this segment would remain in the existing LOSSAN rail corridor, so the potential for impacts would be reduced. Improvements at the Santa Fe Depot would be minimal and would not substantially alter the existing conditions in or around the historic rail station.

3.10.4 Mitigation Strategies

General mitigation strategies are discussed as part of this programmatic evaluation. Should the Rail Improvements Alternative be carried forward, the Department would consult with SHPO to define and describe general procedures to be applied in the future for fieldwork, methods of analysis, and potential specific mitigation measures for impacts to cultural and paleontological resources in the proposed Rail Improvements corridors, which could be reflected in a programmatic agreement between the Department and SHPO. Mitigation measures would be required for significant impacts on cultural resources that are listed or determined to be eligible for listing in the NRHP or CRHR.

A. ELIGIBLE OR LISTED ARCHAEOLOGICAL SITES

The following are potential mitigation measures for eligible or listed archaeological sites.

- Consider avoidance of impact.
- Incorporate the site into parks or open space (P.R.C. § 21083.2).
- Cap or cover the site before construction.
- Provide data recovery.
- Develop procedures for fieldwork, identification, evaluation and determination of potential effects to cultural resources in consultation with SHPO and Native American tribes.

Avoidance is preferred, but if adjustments to the alignment plan or profile are not feasible, data recovery may be provided. Data recovery consists of archaeological excavation of an adequate sample of site contents so that the research questions applicable to the site can be addressed. Recovery of important information from the site mitigates the information loss that would result from site destruction. If only part of a site were impacted by the project, data recovery would only be necessary for that portion of the site. Data recovery would not be required if the agency determines prior testing and studies had adequately recovered the scientifically consequential information from the resources (CEQA Guidelines, 14 C.C.R. § 15126.4[b]).

B. LISTED OR ELIGIBLE HISTORIC STRUCTURES AND BUILDINGS

Mitigation measures for listed or eligible historic structures and buildings should include consideration of the following, where appropriate, in accordance with the Secretary of the Interior's standards for the treatment of historic properties and the CEQA Guidelines.

- Repair
- Stabilize
- Rehabilitate
- Restore
- Relocate
- Reconstruct

Mitigation for impacts on a structure that would be demolished would include documentation following Historic American Building Survey (HABS) or Historic American Engineering Record (HAER) standards. This includes large-format photography and detailed architectural description. Under the NHPA, this could adequately address adverse impacts. However, under CEQA guidelines, in some circumstances, documentation may not mitigate the effects to a level where there would be no significant effect resulting from demolition of eligible or listed structures (CEQA Guidelines, 14 C.C.R. § 15126.4[b][2]). Mitigation measures for alterations to the setting of historic structures and buildings typically consist of documentation of the setting prior to project construction and/or redesign of the project to make it more compatible with the original setting.

C. PALEONTOLOGICAL RESOURCES

Mitigation measures for paleontological resources would be developed and implemented at the project level. The following measures may be included.

- Educate workers.
- Recover fossils identified during the field reconnaissance.
- Monitor construction.
- Develop protocols for handling fossils discovered during construction, likely including temporary diversion of construction equipment so that the fossils could be recovered; identified; and prepared for dating, interpreting, and preserving at an established, permanent, accredited research facility.

Additional site-specific work would be required during project-level environmental review should a decision be made to proceed with the proposed rail improvements. At the conclusion of the programmatic environmental review process, the Department and the FRA, in consultation with the SHPO, may develop a programmatic memorandum of agreement (PMOA) to describe expectations for the next phase of fieldwork, eligibility determination, and documentation under Section 106 of the NHPA and pursuant to CEQA. The PMOA may specify procedures for the identification and evaluation of impacts for future projects.

3.10.5 Subsequent Analysis

The following paragraphs describe the procedures that would be necessary at the next stage of environmental review to determine appropriate and feasible mitigation measures in consultation with the SHPO, if a decision is ultimately made to go forward with the proposed rail improvements. These procedures would also satisfy CEQA requirements. Under NHPA Section 106 and implementing regulations (36 C.F.R. Part 800), the procedures would include identifying resources with the potential to be affected; evaluating their significance under NRHP and CEQA; and identify any significant or substantially adverse impacts, and then evaluating potential mitigation.

Identifying potentially affected archaeological and historical resources would require field surveys of all unsurveyed areas within a more specifically defined study area that would include the area where direct and indirect impacts from construction could occur (including locations of easements and construction-related facilities, such as equipment staging areas, borrow and disposal areas, access roads, and utilities) and the area(s) where the settings of any eligible historic buildings and structures, or the buildings and structures themselves, could be materially or significantly altered.

All identified resources would then be evaluated using NRHP and CRHR eligibility criteria. Evaluating archaeological sites may require preparing test plans for archaeological resources that contain regionally relevant research questions. The Department and the FRA would consult with the SHPO on any test plans and determinations of eligibility for evaluated resources. The impacts of a proposed specific project on resources determined eligible would be analyzed. An impact analysis report may then be reviewed with the SHPO.

Mitigation measures needed to address impacts to specific resources could then be developed and incorporated in a memorandum of agreement (MOA) between the SHPO, the Advisory Council on Historic Preservation (ACHP), the FRA, and the Department during the preparation of project-specific environmental evaluation. The mitigation measures in the MOA would then be incorporated into project-specific environmental documentation and project approvals.

A paleontological resource assessment program would also be completed as part of the subsequent analysis for project environmental review. The assessment program would include a field reconnaissance to identify exposed paleontological resources and more precisely determine potential paleontologic sensitivity for the project. A paleontological resources treatment plan would be prepared by a qualified paleontologist. The plan would be included in project approval and would address the treatment of paleontological resources discovered prior to and during construction.

Further consultation would also occur at the project level with the Native American Heritage Commission as necessary and with Native American groups when traditional territories may be close to areas of potential effect for the project. Additionally, more specific information related to traditional cultural sites of concern would be obtained as necessary.

3.11 GEOLOGY AND SOILS

This chapter describes existing geologic conditions in the LOSSAN region and analyzes the potential geological impacts of each alternative and proposed rail alignment option. This analysis focused on potential impacts related to seismic hazards, landslide hazards, locations of oil and gas fields and mineral resource sites; and on bedrock and other conditions that could affect excavation.

3.11.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

A number of state and local regulations apply to geologic hazards and engineering geologic practice. The following paragraphs summarize key regulatory provisions; more detailed discussion is deferred to project-level environmental documentation because these regulations, if applicable, relate to site-specific conditions and thus would be applied as appropriate at the project level rather than the program level.

Principal state guidance relating to geologic hazards is contained in the Alquist-Priolo Act (Public Resources Code § 2621 et seq.), and in the Seismic Hazards Mapping Act of 1990 (Public Resources Code §§ 2690–2699.6). The Alquist-Priolo Act prohibits the location of most types of structures for human occupancy across the active traces of faults in earthquake fault zones shown on maps prepared by the State Geologist, and regulates construction in the corridors along active faults (earthquake fault zones). The Seismic Hazards Mapping Act of 1990 focuses on hazards related to strong ground shaking, liquefaction, and seismically induced landslides. Under its provisions, the state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and the maps are to be used by cities and counties in preparing their General Plans and adopting land use policies to reduce and mitigate potential hazards to public health and safety.

Site-specific geotechnical investigations may be prepared to provide a geologic basis for the development of appropriate construction design for proposed projects, including mitigation/remediation of geologic hazards where this is possible. Geotechnical investigations typically assess the bedrock and Quaternary geology, the geologic structure, the soils, and the previous history of excavation and fill placement on and in the vicinity of the site for a proposed project. They may also address the requirements of the Alquist-Priolo Act and the Seismic Hazards Mapping Act.

Pursuant to the Surface Mining and Reclamation Act (Public Resources Code § 2710 et seq.), the State Mining and Geology Board identifies in adopted regulations areas of regional significance that are known to contain mineral deposits judged to be important in meeting the future needs of the area. (See Public Resources Code §§ 2726 and 2790; Title 14 C.C.R. 3550, et seq.) The State Mining and Geology Board also adopts state policy for the reclamation of mined lands and certifies local ordinances for the approval of reclamation plans as being consistent with state policies (Public Resources Code §§ 2755–2764, 2774 et seq.).

B. METHOD OF EVALUATION OF IMPACTS

To evaluate potential impacts related to geology and soils, each alternative and alignment option was ranked for potential seismic hazards (ground shaking and ground failure potential), surface rupture hazard (number of active fault crossings), slope instability, areas of difficult excavation, presence of oil and gas fields (presence of the resource and/or production facilities), and presence of economic mineral resources. The analysis was performed generally on the basis of existing data available in GIS format as opposed to detailed site investigations. The geologic data provided in this section are intended for planning purposes and are not intended to be definitive for specific sites. Alignments were evaluated as having high, medium, or low potential for geologic impacts based on the number of geologic constraints identified. Stations were evaluated as having either high or low potential for geologic impacts, based on the number of geologic constraints identified. These rankings made it possible to provide a rough comparison of the potential geologic constraints affecting each alignment option.

Table 3.11-1 summarizes the ranking criteria for potential geologic and soils impacts. The following paragraphs describe the ranking process.

Table 3.11-1.
Ranking System for Comparing Impacts Related to Geology/Soils/Seismicity

Impact Ranking	**Seismic Hazards** (% of length)	**Active Fault Crossings** (number of crossings)	**Slope Instability** (% of length)	**Difficult Excavation** (% of length)	**Oil and Gas Fields** (% of length)	**Mineral Resources** (present or not present)
Alignments						
High	>50	2+	>10	>25	>20	>20
Medium	10–50	1	5–10	10–25	10–20	10–20
Low	<10	0	<5	<10	<10	<10
Stations						
High	Present	Present	Present	Present	Present	Present
Low	Not Present	Not Present	Not Present	Not Present	Not Present	Not Present

Seismic Hazards

Seismic hazards that could potentially constrain the design of proposed facilities were evaluated on the basis of potential for strong ground motion and potential for liquefaction. Areas potentially subject to strong ground motion were defined for this program-level study as areas where peak horizontal ground accelerations in an earthquake may exceed 0.50g (i.e., areas where peak horizontal ground acceleration may exceed 50% of the acceleration due to gravity) as mapped by the California Geological Survey (CGS 2002). This acceleration is used to calculate the horizontal force a structure may be subjected to during an earthquake. For this analysis, liquefaction was conservatively assumed to be possible in all areas where peak ground accelerations could exceed 0.30g, except for areas mapped as underlain by bedrock. Where groundwater levels were not known from existing literature, they were conservatively assumed to be high, contributing to increased potential for liquefaction.

The ranking system for impacts related to seismic hazards used the percentage of each potential alignment within strong ground motion zones and/or potentially liquefiable zones. Station sites were evaluated by determining whether any portion of a proposed station site or an existing station where improvements are proposed would be within a strong ground motion zone or potentially liquefiable zone.

- Alignments: High, medium, or low, based on percentage of alignment length in strong ground motion zones plus the percentage of length in potentially liquefiable zones.
- Stations: High if any part of the site is within a strong ground motion zone or potentially liquefiable zone; otherwise, low.

Potential for Surface Rupture (Active Fault Crossings)

Surface rupture hazard was evaluated based on whether any portion of an alignment option or station would be located within 200 ft (62 m) of the mapped trace of any fault with known or inferred movement during Quaternary time (the past 1.6 million years). If any portion of a proposed alignment or potential station site was within 200 ft (60 m) of a Quaternary fault, it was identified as crossing an active fault trace. As described below, the State of California defines active faults as those that show evidence of movement in the last 11,000 years. Because of the extreme disruption of transit facilities that can result from surface fault rupture, this analysis deliberately adopted a conservative criterion for the assessment of surface rupture hazard and included potentially active faults, those with known or inferred movement over Quaternary time.

The ranking system for impacts related to surface rupture hazard was based on the number of active fault crossings identified.

- Alignments: High, medium, or low, based on number of active (recent or Quaternary) fault crossings.
- Stations: High if any part of the site is within 200 ft (60 m) of an active (recent or Quaternary) fault; otherwise, low.

Slope Instability

Slope stability was evaluated based on the geologic formations or units present along each alignment and at each station site, as shown in statewide mapping compiled by Jennings (1977, 1991). Each of the mapped geologic units was assigned a rating for inferred slope stability, based primarily on lithology (physical characteristics of the rock formation) and age. This approach allowed the identification of areas at risk for slope instability. A conservative 200 ft (60 m) buffer was included around each identified area of instability.

The ranking system for impacts related to slope instability was based on the percentage of each alignment within potentially unstable zones. Station sites were evaluated by determining whether any portion of the site is within an area of potential slope instability.

- Alignments: High, medium, or low, based on percentage of alignment length in potentially unstable zone.
- Stations: High if any part of the site is within a potentially unstable zone; otherwise, low.

Difficult Excavation

Areas of potentially difficult excavation were identified based on bedrock geologic characteristics in combination with the presence of faults of any age, based on statewide mapping compiled by Jennings (1977, 1991) and information from selected 1:250,000-scale geologic map sheets for the study region published by the California Geological Survey. Each fault crossing was conservatively assumed to be approximately 600 ft (183 m) wide. Geologic cross sections were prepared to assess subsurface tunneling conditions along proposed rail tunnel segments.

The ranking system for impacts related to difficulty of excavation was based on the percentage of each alignment where excavation would be required within identified areas of difficult excavation. Stations were evaluated by determining whether any portion of the site is within an identified area of difficult excavation.

- Alignments: High, medium, or low, based on percentage of surface segments in hard rock plus percentage of tunnel segments within fault zones.
- Stations: High if any part of the site is within a hard rock zone or fault zone; otherwise, low.

Oil and Gas Fields

Areas where the presence of oil and gas could constrain project construction or operation were identified on the basis of published resource maps produced by the California Department of Conservation's Division of Oil, Gas, and Geothermal Resources (California Department of Conservation 2001a, 2001b).

The ranking system for impacts related to oil and gas fields was based on the percentage of each proposed alignment within identified oil and gas field areas. Station sites were evaluated by determining whether any portion of the site is within a mapped oil and gas field area.

- Alignment: High, medium, or low, based on percentage of alignment length within mapped oil and gas fields.
- Stations: High if any part of the site is within a mapped oil and gas field; otherwise, low.

Mineral Resources

Areas where the project could affect mineral resource extraction (primarily sand and gravel deposits) were identified on the basis of reports and published maps by the United States Geologic Survey (USGS), and California Geologic Survey (CGS).[1]

[1] Frank, David G. 1999. An Arc/Info Point Coverage of Mineral Resource Data System (MRDS) Location in Eleven Western States. United States Geologic Survey, Open File Report 99-169.

California Department of Conservation, California Geological Survey (CGS). No Date. *Map of California, Principal Mineral-Producing Localities--1990*. 2000.

Morton, P.K., and Miller, R.V. 1981. Geologic Map of Orange County Showing Mines and Mineral Deposits, California Division of Mines and Geology: Bulletin 204, Plate 1.

Weber, F.H., Jr. 1963. Geology and Mineral Resources of San Diego County, California: California Division of Mines and Geology, County Report 3.

The ranking system for mineral resources impacts was based on the number of mineral resources sites intersected by each alignment option. Station sites were evaluated by determining whether any portion of the site is within a mineral resource area.

- Alignments: High, medium, or low, based on number of mapped resources within 200 ft (60 m) of a mineral resource area.
- Stations: High if any part of the site is within 200 ft (60 m) of a mineral resource area; otherwise, low.

3.11.2 Affected Environment

A. STUDY AREA DEFINED

The study area for geology and soils is defined as the corridor extending 200 ft (60 m) on each side of the alignment centerlines, and a 200-ft (60-m) radius around each station site. This distance incorporates all cross-sections with the exception of deep cuts and fills. As described in Method of Evaluation of Impacts above, alternatives were compared based on the number of sites with potential geologic or soils constraints per alignment, which depends on the length and location of the alignment; broadening the study area to include the entire width of deep cut-and-fill sections would not change the results of the comparison.

B. GEOLOGY AND SOILS IN THE STUDY AREA

The following sections describe the general setting and key project constraints related to geology and soils.

Geologic Setting and Topography

The northern, inland portion of the study area is located primarily within the Los Angeles Basin. The basin comprises a wide lowland coastal plain, which slopes gradually southward and westward toward the Pacific Ocean. The coastal plain overlies a structural trough that was filled with a thick sequence marine and non-marine sediments as the basin subsided.

The Los Angeles Basin occurs at the intersection of the north-northwest trending Peninsular Ranges Geomorphic Province and the east-west trending Transverse Ranges Geomorphic Province. The Peninsular Ranges are characterized by a series of mountain ranges and intervening valleys that extend from Orange County to Baja California. The Transverse Ranges extend eastward where they merge with the Mojave and Colorado Deserts.

The southern end of the Los Angeles to Orange County study area crosses from the Los Angeles Basin into the western foothills of the Santa Ana Mountains (part of the Peninsular Ranges) near Irvine and continues southwestward to Pacific coast near Dana Point. The southern reaches of the rail alignment options are situated in the coastal section of the Peninsular Range province, a California Geomorphic province with a long and active geologic history. This portion of the alignments traverse an elevated coastal plain capped by Quaternary terrace deposits and recent alluvial, slopewash and landslide materials deposited by erosional processes (Jennings 1977, 1991).

The inland alignments extending south from Union Station to Irvine are predominantly underlain by a thick sequence of unconsolidated Quaternary alluvium. Two short segments along the LOSSAN alignment pass over Pleistocene nonmarine terrace deposits from East Los Angeles to Norwalk. From Irvine to El Toro the rail route is underlain by alluvium and terrace deposits. South of El Toro extending to Capistrano Beach, the alignments traverse poorly consolidated stream terrace deposits and the moderately consolidated Pliocene marine Capistrano Formation. The Capistrano Formation is prone to landsliding, including a large slide under I-5 at Capistrano Beach.

Surficial geologic units within the coastal LOSSAN study area, from San Juan Capistrano to San Diego, consist of artificial fill and Quaternary alluvial, beach, marine terrace, and slopewash deposits overlying Tertiary sedimentary bedrock units (Leighton & Associates 2003). Surficial materials tend to be poorly consolidated and have a broad range in thickness. Tertiary bedrock units consist of sandstones and sandstone with interbedded cobble conglomerate, siltstones, and shales.

Both from a scenic and engineering perspective, two sensitive areas in the LOSSAN corridor are the San Clemente and Del Mar coastal bluffs. Capistrano Formation siltstone and overlying marine terrace deposits, alluvium, and colluvium occur in the Dana Point/San Clemente area. The Del Mar bluffs area, is underlain by the Torrey Sandstone Formation as well as the claystone of the Del Mar Formation.

Elevations along the LOSSAN corridor from Union Station to the San Juan Capistrano city limits range from approximately 58 to 476 ft (18 to 145 m) above mean sea level. The coastal portion of the corridor consists of a generally southeast to northwest trending topographic alignment extending from San Juan Capistrano to downtown San Diego. Topographic elevations along the existing railway range from approximately 10 to 120 ft (3 to 37 m) above mean sea level. Surrounding topography generally consists of gently westward to southwestward sloping landforms, including terraces and hillsides subdued by erosional processes and human development.

Locally, steep topography is commonly the result of incision by the generally westward flowing drainages, resulting in oversteepened slopes in some areas outlying the rail corridor. Steep slopes and bluffs resulting from beach side erosion and wave action are adjacent to the rail corridor in the cities of Del Mar and San Clemente.

Seismic Hazards

Description of Seismic Hazards: Seismic hazards can be categorized as either primary or secondary. Primary seismic hazards include surface fault rupture and ground shaking. Secondary seismic hazards include liquefaction and other types of seismically induced ground failure, along with seismically induced landslides.

Surface fault rupture, or ground rupture, occurs when an active fault ruptures at depth to produce an earthquake, and the rupture propagates to the ground surface. Surface rupture can also occur as a result of slow, gradual motion referred to as fault creep. An area's potential for ground rupture is assessed based on the displacement history of the area's faults. Two categories of faults have been defined by the State of California in Special Publication 42 (Hart and Bryant 1997). Active faults are those that are known or inferred to have experienced movement in the past 11,000 years and are considered to have a high potential for future ground rupture. Potentially active[2] faults are those that are not known to have experienced movement in the past 11,000 years but have moved during Quaternary time (the past 1.6 million years). These faults may also pose a surface rupture hazard, but the hazard is more difficult to evaluate. For the purpose of this study, both active and potentially active faults were evaluated, and considered active faults in subsequent sections.

Ground shaking occurs in response to the release of energy during an earthquake. The energy released travels through subsurface rock, sediment, and soil materials as seismic waves, which result in motion experienced at the ground surface.

Liquefaction and other types of seismically induced ground failure reflect loss of strength and/or cohesion when earth materials are subjected to strong seismic ground shaking. Earthquakes can also trigger landslides where slopes are prone to failure because of geologic conditions or because of modifications during construction.

Surface fault rupture, ground shaking, and seismically induced ground failure all can result in substantial damage to structures. Thorough assessment of the existing hazard combined with appropriate design and construction can substantially reduce the potential for damage.

<u>Major Active Faults in the Study Area</u>: Three sources were used to evaluate faulting in the study area, including the Fault Activity Map of California (Jennings, 1994), Alquist-Priolo Earthquake Fault Zones of California (CGS, 2002), and fault source information used by the California Department of Transportation (Mualchin, 1996). These sources were used to compile Figure 3.11-1, Faults, and Figure 3.11-2, Quaternary and Alquist-Priolo Earthquake Fault Zones. Alquist-Priolo mapping represents those zones where the CGS considers faults to be present requiring further site-specific fault studies and recommendations for development. These zones generally include faults with known movement within the past 10,000 years (i.e., Holocene).

The seismicity of southern California is dominated by the intersection of the north-northwest trending San Andreas fault system and the east-west trending Transverse Ranges fault system. The study area is subject to ground shaking associated with earthquakes on faults of both these systems. Active faults of the San Andreas system are predominantly strike-slip faults accommodating translational movement. Active reverse or thrust faults in the Transverse Ranges include blind thrust faults responsible for the 1987 Whittier Narrows Earthquake, the 1994 Northridge Earthquake, and the range-front faults responsible for uplift of the Santa Monica and San Gabriel Mountains.

The major active faults in the LOSSAN region include the Newport-Inglewood, Rose Canyon, Raymond, Whittier, and Elysian Park faults. All of these faults are capable of generating significant groundshaking in areas along the existing LOSSAN corridor and proposed alignment options.

The Newport-Inglewood Fault Zone is a broad zone of discontinuous faults and folds striking southeastward from near Santa Monica across the Los Angeles basin to Newport Beach, where it trends offshore and merges with the Rose Canyon Fault Zone offshore of Oceanside (Ziony and Yerkes, 1985, Jennings, 1994). None of the proposed

[2] The term “potentially active” is under review for alternative nomenclature by California Geologic Survey.

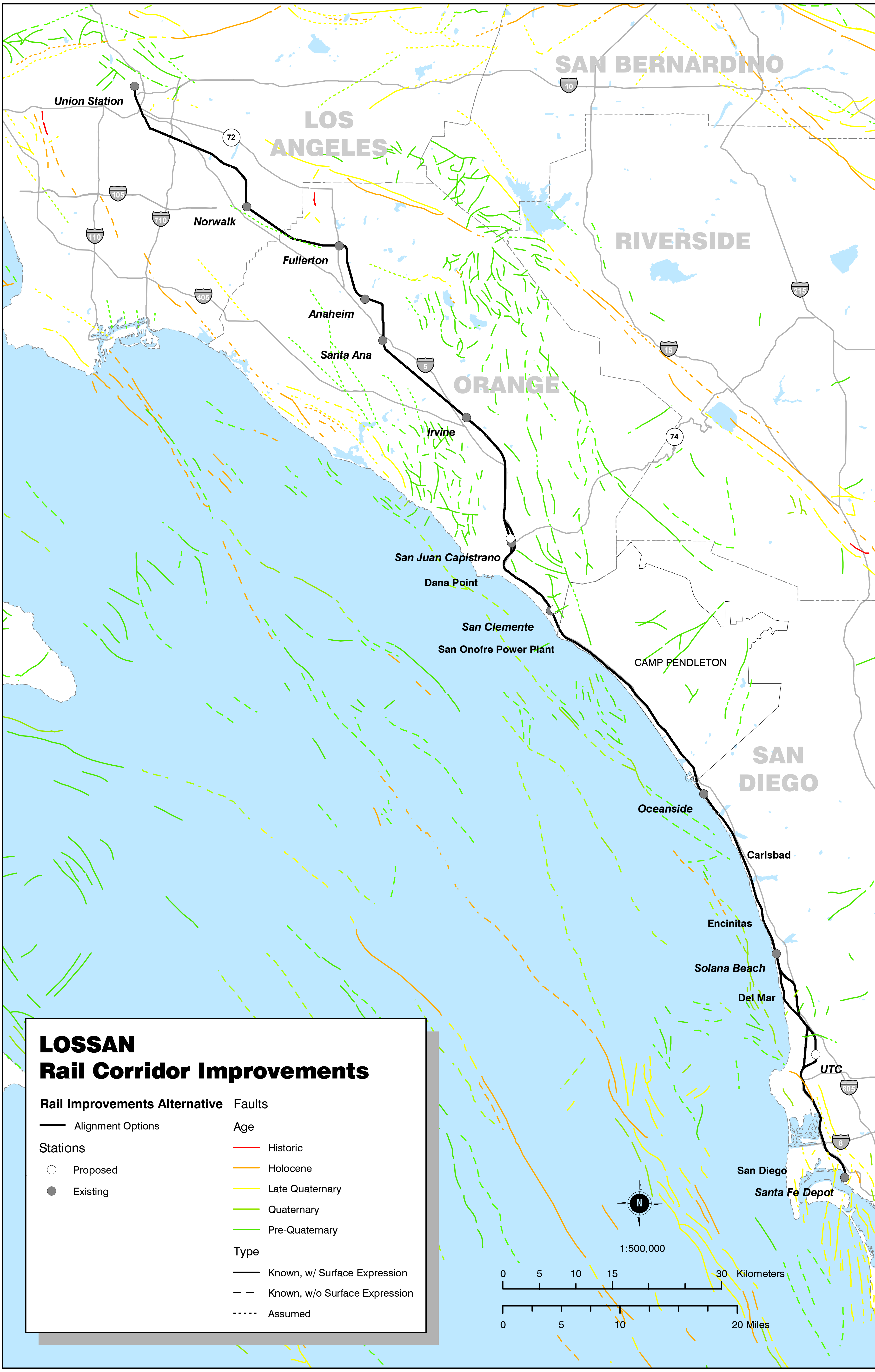
rail improvement alignment options north of Highway 52 cross this or any other active fault, and none of these alignments are located within a mapped Alquist-Priolo Earthquake Fault Zone (Hart, 1997). Ground rupture due to faulting is not considered a significant hazard in the area north of Highway 52 (although it is a possibility at any site along the rail corridor). However, the proximity of the Newport-Inglewood fault to the proposed northern coastal alignments such as those in San Juan Capistrano, Dana Point, San Clemente, and Camp Pendleton, and its potential for generating large earthquakes, does make the Newport-Inglewood Fault a potential seismic hazard to the existing rail corridor and proposed improvements.

The Rose Canyon fault is a southern continuation of the Newport-Inglewood. This fault runs generally north-south through the San Diego area from approximately La Jolla through the downtown San Diego area and into San Diego Bay. The Rose Canyon fault is Alquist-Priolo zoned from where it comes onshore in La Jolla to approximately Mission Bay. The proposed rail alignment between Highway 52 and the Santa Fe Depot crosses the Rose Canyon fault in two locations (at the San Diego River bridge and within the trench alignment), and are within mapped Alquist-Priolo or City of San Diego Special Studies zones (CDMG, 1991 and 2002). Therefore, shallow ground rupture would be a consideration in project-level investigations, and during preliminary design and planning for proposed improvements in these areas.

The Raymond, Whittier, and Elysian Park active fault zones are in the northern part of the LOSSAN region. Of these, the one of most concern in the downtown Los Angeles area is the Elysian Park fault. This is a northward dipping, blind thrust fault and has no mappable surface expression. Faults of this type are classified as Special Seismic Sources by the California Department of Transportation (Mualchin, 1996). This fault is capable of producing earthquakes resulting in levels of damage equal to or greater than the 1971 San Fernando earthquake, the 1987 Whittier Narrows earthquake, and the 1994 Northridge earthquake -- all earthquakes produced by blind thrust faults previously thought to be inactive.

<u>Liquefaction</u>: Liquefaction occurs when three general conditions exist: (1) shallow groundwater, (2) low-density sandy soils, and (3) high-intensity ground motion. Effects of liquefaction on level ground include sand boils, settlement, and bearing capacity failures below structural foundations. Groundwater contours for the entire project study area were not available with reasonable accuracy that would be beneficial to this preliminary evaluation. Therefore, for this program-level evaluation, all areas were assumed to be potentially underlain by shallow groundwater. This allowed identification of potentially liquefiable zones by including areas where ground motions exceed 30 percent (i.e., 0.30g) but excluding areas mapped as underlain by rock. Areas of the project region meeting these criteria have been mapped on Figure 3.11-3, Potential Liquefaction Zones.

Based on preliminary evaluation, it is anticipated that saturated older and younger alluvium will underlie the proposed improvements within the significant drainages that cross the rail corridor. Based on qualitative analysis, these deposits are considered liquefiable from the surface to depths on the order of 50 to 60 ft (15 to 18 m). This includes alluvial deposits underlying the existing bridge structures and the embankment fills. Areas underlain by Quaternary terrace material as well as all bedrock units are not considered liquefiable due to their high density, clay content, age, and/or unsaturated conditions. As shown on Figure 3.11-3, areas believed to be potentially susceptible to liquefaction are present throughout the study area.



Source : Jennings, 1977

Caltrans
U.S. Department of Transportation
Federal Railroad Administration

FIGURE 3.11-1
Faults
LOSSAN Rail Corridor Improvements
Program Environmental Impact Report / Environmental Impact Statement

Source : Jennings, 1985, USGS, 1998

FIGURE 3.11-2

Quarternary Faults and Alquist-Priolo Earthquake Fault Zones

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

U.S. Department of Transportation Federal Railroad Administration

Source : Jennings, 1977

FIGURE 3.11-3
Potential Liquefaction Zones
LOSSAN Rail Corridor Improvements
Program Environmental Impact Report / Environmental Impact Statement

U.S. Department of Transportation
Federal Railroad Administration

Caltrans

Unstable Slopes

Slopes are considered unstable (prone to failure or landslides) when soil or rock strength is insufficient to resist gravitational forces or other loads. Slope instability can occur naturally due to factors such as fracture patterns, soil saturation, or steep slopes. Slope failure can also be triggered by seismic activity or by improperly designed construction.

If slope instability is not adequately characterized and mitigated during design and construction, it can cause severe damage to surface and near-surface improvements as well as risks to public safety. However, slope instability can generally be addressed with planning and design.

For purposes of this analysis, the criteria for mapping potentially unstable slopes was all areas in which slope gradients exceed 33% and are not underlain by rock units having high strength characteristics. Figure 3.11-4 shows areas identified as unstable based on these criteria.

The extent of potentially unstable slopes meeting these criteria within the inland project areas is almost zero. The Los Angeles to Orange County alignments are all within established transportation corridors in areas of low relief. No substantive areas of unstable slopes were identified in this inland part of the study area.

Through the cities of Del Mar and San Clemente, as well as a limited portion of Encinitas, rail corridor improvements are proposed within the area under the influence of the coastal sea bluff. In general, coastal bluff retreat is controlled by a combination of marine erosion and subaerial erosion. Marine erosion results from the effects of the ocean and wave action along the base of the bluffs. Subaerial erosion results from those erosional influences that exist above the high-water line (or wave run-up line) and includes such items as erosion due to surface runoff, ground water seepage, wind, pedestrian traffic, rodent activity, and slope instability. As a result, the bluffs are consistently impacted by marine and subaerial erosional processes. In Encinitas, the rail improvement options are set back east of Pacific Coast Highway, which provides a buffer zone between the alignment options and the coastal bluffs.

In Del Mar, the existing LOSSAN rail alignment is constructed across the top of the relatively flat mesa top, generally at or near the elevation of the bluff top, 40 to 65 ft (12 to 20 m) above sea level. In San Clemente, the existing rail alignment is generally on a shallow topographical bench between the base of the coastal bluffs and the beach. This rail alignment and its associated rip-rap protection provide a buffer from wave action, so the cliffs are dominantly subject to subaerial erosional processes.

A number of remedial or stabilization measures exist along the existing railway in the Del Mar and San Clemente areas. These include older improvements along the coastal bluff face through both cities that are in need of ongoing repair and maintenance. For example, in Del Mar, wooden and concrete seawalls along portions of the bluff are currently protecting portions of the base of the bluff against erosion due to typical wave impact. However, these walls are occasionally of insufficient height to block heavy storm surf or at least they require periodic maintenance to remain effective. In San Clemente, the existing rip-rap berms also require maintenance.

Areas of Difficult Excavation

Subsurface geologic conditions will largely determine the ease or difficulty of excavation, which will in turn indicate the appropriate excavation technique for use in various areas.

For instance, hard unfractured bedrock may be difficult to excavate using bulldozers and other earthmoving equipment, or too resistant to tunneling using a tunnel boring machine (TBM); in these areas, blasting may be required. On the other hand, fractured rock that contains groundwater can also be difficult to excavate using tunneling methods. Faulted material can pose an additional challenge by contributing to instability at the tunnel face.

The proposed inland alignments (north of San Juan Capistrano) are entirely located within unconsolidated sediments and poorly consolidated sedimentary rock, and are not expected to encompass any areas of difficult excavation.

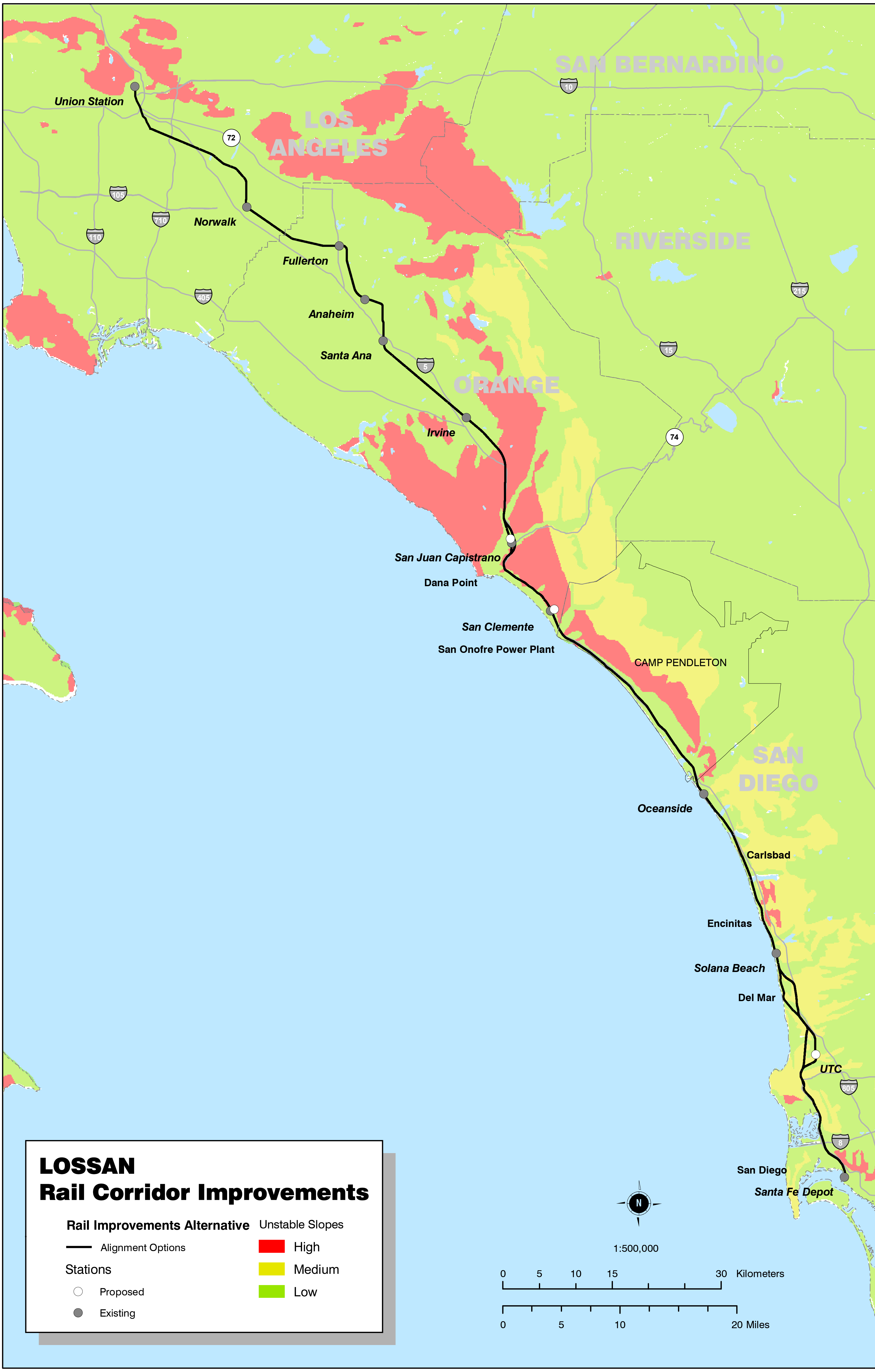
Within the coastal route of the LOSSAN corridor, surficial materials are generally loose and poorly consolidated and should be rippable with conventional earthwork equipment. If deeper excavations were made in these areas (i.e., trenches and tunnels), they would occur within sedimentary rock units which are generally penetrable with conventional excavation and tunnel-boring equipment. However, due to the presence of fault zones and some hardened rock units, potentially difficult excavation areas occur between San Juan Capistrano and San Clemente, and between the I-5/805 Split and the Santa Fe Depot in San Diego.

Geological Resources

Geological resources in California include oil and gas fields, geothermal fields, and a wide range of mineral resources. The principal constraint associated with oil, gas, geothermal, and mineral resources is the need for planning to ensure that construction of new facilities would not conflict with the removal of economically important resources and would avoid known problem areas to the extent feasible. In addition, the presence of even small (noneconomic) quantities of oil or gas in the subsurface can pose toxic or explosive hazards during construction, requiring specific precautions, and may also necessitate special designs and monitoring during the operation of subsurface structures such as subway tunnels. Similarly, certain mineral resources, such as serpentine (the source of natural asbestos) can result in hazardous working conditions if not properly managed.

The Union Station to Irvine segment crosses one large oil field, the Santa Fe Springs field north of the existing Norwalk Station. The abandoned La Mirada field lies just south of the proposed rail alignment southeast of Santa Fe Springs. South of Irvine, there are no oil or gas fields that coincide with any of the rail alignment options.

All of the alignment options are within previously developed transportation corridors and no existing mines or mineral resource sources are located within the 200-ft (60-m) study area of the alignments and stations (CGS, 1999).



Source : USGS, 1998

FIGURE 3.11-4

Potentially Unstable Slopes

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

U.S. Department of Transportation Federal Railroad Administration

3.11.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

Existing conditions describe transportation conditions as of 2003. The No Project Alternative includes existing transportation infrastructure plus all planned, approved, and funded projects that can reasonably be expected to be in operation by 2020. This analysis assumed that existing major infrastructure (bridges, for example) was designed, has been retrofitted, or is currently scheduled to be retrofitted to meet current design standards for seismic safety and other geologic constraints, and that future projects included in the No Project Alternative would incorporate similar safeguards as part of the development, design, and construction process. However, it is not possible to eliminate or mitigate all geologic hazards through design and construction. Some types of geologic hazards (seismic hazards in particular) are also unpredictable. While it is difficult to evaluate the change in hazards (potential for geologic impacts) between existing conditions and No Project conditions, it is likely that some improvements in technology and materials as well as more stringent design codes will be implemented in the next 20 years to address seismic design of new structures. Thus the No Project Alternative would be somewhat improved from the existing conditions, but existing geologic risks were used to represent geologic risks under the No Project Alternative.

Beyond the potential geologic impacts for programmed improvements (to be addressed in other project-level documents), the No-Project Alternative potentially would have additional impacts on the coastal bluff areas in Del Mar and San Clemente, as compared to the Rail Improvement Alternative. The existing LOSSAN rail corridor is constructed across the top of the bluffs in Del Mar and along the toe slope of the bluffs in San Clemente. Under the No Project Alternative, the existing rail corridor would continue to operate along these coastal bluffs, requiring continued stabilization and drainage efforts to counteract ongoing aerial and subaerial erosion. The Rail Improvement Alternative would potentially result in a beneficial impact to these bluff areas by precluding further rail construction along the bluffs and removing the existing rail service from the bluff areas.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

This analysis focused on comparing the difference in potential impacts anticipated with the proposed alignment options under the Rail Improvements Alternative, using 2020 No Project conditions as a baseline. Table 3.11-2 summarizes the types of impacts that may result from the various geological conditions evaluated in this report.

Table 3.11-2
Types of Potential Impacts from Geologic Conditions

Geologic Condition	Potential Impacts
Seismic hazards	Potential risk to worker and public safety due to collapse or toppling of partially constructed or completed facilities during strong earthquakes. Potential risk to public safety due to interruption of service due to derailment caused by ground motion during strong earthquakes. Damage to facilities due to secondary hazards over soft or filled ground.

Table 3.11-2
Types of Potential Impacts from Geologic Conditions (continued)

Geologic Condition	Potential Impacts
Active fault crossings	Potential risk to worker or public safety due to ground rupture along active faults. Potential risk to public safety due to interruption of service due to derailment by ground rupture along active faults.
Slope stability	Potential risk to worker or public safety due to failure of natural and/or construction cut slopes or retention structures.
Difficult excavation	Potential cost and duration of surface or tunnel excavations during construction.
Oil and gas fields	Potential migration of potentially explosive and/or toxic gases into subsurface facilities.
Mineral resources[1]	Potential project costs and delays due to potential impacts on existing mineral resource areas and facilities, including potential remediation.

[1]No mineral resources were identified within the study area for the Rail Improvement Alternative.

Table 3.11-3 shows potential impact ratings and the geologic constraints within the study area of each of the alignment options. Potential geologic impacts that are categorized as high should not be regarded as precluding construction of an alignment option, or as necessarily indicating that these would be potentially significant impacts. Rather, they identify aspects of project design where additional study would be needed and where engineering and design effort would be required to avoid or mitigate the potential impacts.

Table 3.11-3
Summary of Potential Impact Rankings and Geological Constraints

	Seismic Hazards (% of Length)	**Active Fault Crossings** (# of Crossings)	**Slope Stability** (% of Length)	**Difficult Excavation** (% of Length)	**Oil and Gas Fields** (% of Length)
Union Station To Fullerton Station -- 4th Main Track	High (100)	Low (0)	Low (0)	Low (0)	Medium (12)
Fullerton Station To Irvine Station--Double Tracking					
AT-GRADE between Orange and Santa Ana	High (100)	Low (0)	Low (0)	Low (0)	Low (0)
TRENCH between Orange and Santa Ana	High (100)	Low (0)	Low (0)	Low (0)	Low (0)
Stations Fullerton	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present))
Anaheim	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)
Santa Ana	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)
Irvine	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)

Table 3.11-3
Summary of Potential Impact Rankings and Geological Constraints (continued)

	Seismic Hazards (% of Length)	**Active Fault Crossings** (# of Crossings)	**Slope Stability** (% of Length)	**Difficult Excavation** (% of Length)	**Oil and Gas Fields** (% of Length)
San Juan Capistrano Double Tracking					
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	Medium (26)	Low (0)	Low (0)	Medium (10)	Low (0)
AT-GRADE and Cut/Cover TRENCH along east side of Trabuco Creek	Low (0)	Low (0)	High (76)	Low (0)	Low (0)
Stations San Juan Capistrano	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)
Dana Point/San Clemente Double Tracking					
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	Low (0)	Low (0)	Low (0)	Medium (14)	Low (0)
San Clemente - LONG TWO-SEGMENT TUNNEL	Low (0)	Low (0)	Low (0)	High (50)	Low (0)
Stations San Clemente	High (Present)	Low (Not Present)	Low (Not Present)	High (Present)	Low (Not Present)
Camp Pendleton At-grade Double Tracking	Medium (26)	Low (0)	Low (0)	Low (0)	Low (0)
Oceanside/Carlsbad Double Tracking					
Carlsbad - AT-GRADE; double tracking	Medium (11)	Low (0)	Low (0)	Low (2)	Low (0)
Carlsbad -TRENCH; double-tracking	Low (9)	Low (0)	Low (0)	Low (0)	Low (0)
Stations Oceanside	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)
Encinitas/Solana Beach Double Tracking					
Encinitas - AT-GRADE;	Medium (15)	Low (0)	Low (4)	Low (0)	Low (0)
Encinitas - SHORT TRENCH	Medium (15)	Low (0)	Low (2)	Low (0)	Low (0)
Stations Solana Beach	High (Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)	Low (Not Present)
Del Mar Double Tracking					
TUNNEL under Camino Del Mar	High (61)	Low (0)	Low (0)	Low (3)	Low (0)
TUNNEL along I-5	Medium (25)	Low (0)	Low (0)	Low (4)	Low (0)
I-5/805 Split To Hwy 52 Double Tracking					
Miramar Hill TUNNEL	Low (6)	Low (0)	Low (0)	High (30)	Low (0)
I-5 TUNNEL	Medium (13)	Low (0)	Low (0)	High (30)	Low (0)

Table 3.11-3
Summary of Potential Impact Rankings and Geological Constraints (continued)

	Seismic Hazards (% of Length)	**Active Fault Crossings** (# of Crossings)	**Slope Stability** (% of Length)	**Difficult Excavation** (% of Length)	**Oil and Gas Fields** (% of Length)
Stations UTC (Only applies to Miramar Hill Tunnel)	High (Present)	Low (Not Present)	Low (Not Present)	High (Present)	Low (Not Present)
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	Medium (29)	High (2)	High (29)	Medium (18)	Low (0)
Stations Santa Fe Depot	High (Present)	Low (Not Present)	Low (Not Present)	High (Present)	Low (Not Present)

Active seismicity represents a key constraint on design and construction for the Rail Improvements Alternative. Some of the alignment options would require special design, including additional structural ductility and redundancy to withstand severe ground shaking as well as the potential for liquefaction and/or other types of seismically induced ground failure. Active fault crossings would require special designs to minimize potential damage to the tracks and other infrastructure as a result of surface fault rupture and surface disruption associated with fault creep.

The Rail Improvements Alternative ranked high for potential impacts related to seismic hazards between Union Station and Irvine, in the San Juan Capistrano and Del Mar areas, and between Highway 52 and Santa Fe Depot where the alignment would cross the Rose Canyon fault in two locations. These high-impact areas include about half of the total rail corridor length between Union Station and San Diego and would include all existing and proposed station sites except the Irvine Station site.

Seismic hazards do not substantially differentiate between alignment options except in the Del Mar area. Here, the tunnel option under Camino del Mar is rated as having a high seismic hazard because 61 percent of the alignment would cross hazard areas. The I-5 tunnel option in Del Mar is rated as having a medium seismic hazard, with 25 percent of the alignment crossing hazard areas.

Potential slope stability problems were identified in the areas of San Juan Capistrano, and between Highway 52 and Santa Fe Depot. In San Juan Capistrano, the at-grade and cut-and-cover option along the east side of Trabuco Creek would encounter unstable slopes along 76 percent of its length, due to liquefiable soils. The other option in the area, a tunnel under I-5, would avoid unstable areas.

Coastal bluff areas along the existing LOSSAN rail corridor in San Clemente and Del Mar rank high for potential slope instability because of the fragile nature of the bluffs. However, the Rail Improvements Alternative would potentially result in a beneficial impact to the bluff areas in San Clemente and Del Mar by precluding further rail construction along the bluffs and removing the existing rail service from the bluff areas. This improvement would not occur under the No Project Alternative.

The tunnel options proposed as part of the Rail Improvements Alternative would pose design and construction issues because of difficult excavation conditions in some areas. In the Dana Point/San Clemente area, the two alignment options consist of a long, two-segment tunnel (approximately 8 mi (13 km) long), and a short tunnel (approximately 3.5 mi (5.6 km) long) in the same alignment. Both tunnels would encounter areas of difficult excavation. Due to its greater length, the long tunnel would encounter difficult excavation conditions for 50 percent of its length, compared with 14 percent of the length of the short tunnel. However, either tunnel option would result in lower impacts on coastal geology because impacts on the stability of the coastal bluffs would be reduced.

3.11.4 Mitigation Strategies

This document contains a broad program analysis that generally identifies the locations of potential geologic impact areas for the proposed rail improvement options. These are areas that would need further study in environmental documentation at the project level.

Mitigation for potential impacts related to geologic and soils conditions must be developed on a site-specific basis, based on the results of more detailed (design-level) engineering geologic and geotechnical studies. Consequently, geologic and geotechnical mitigation would be identified in subsequent, project-level analysis rather than at the program level. Following is an overview of general approaches to possible geologic and geotechnical mitigation.

A. GROUND SHAKING

The potential for rail safety issues related to ground shaking during a large earthquake cannot be mitigated completely; this holds true for most vehicle transportation systems throughout California. However, some strategies are available to reduce hazards, including the following.

- The potential for collapse or toppling of superstructures (such as bridges or retaining structures) due to strong ground motion can be routinely mitigated by designing structures to withstand the estimated ground motions. Designs typically include additional redundancy and ductility in the structure. The design needed to withstand a certain magnitude of earthquake would be determined during subsequent stages of design and development of proposed facilities. Temporary facilities, such as shoring, would be designed considering a lower probability of seismic events.
- The potential for structural damage and resulting traffic hazard as a result of liquefaction can be mitigated through site-specific methods such as ground modification methods (soil densification) to prevent liquefaction, or structural design (e.g., deep foundations) to accommodate/resist the liquefiable zones.
- It is unlikely that the potential for train derailment during a peak event could be mitigated by designing a track-wheel system capable of withstanding the potential ground motions in most of the project area. Existing train systems throughout California, including the existing service along the LOSSAN corridor, face the same challenge. However, a network of strong motion instruments has been installed throughout California and additional monitoring stations are proposed. These stations provide ground motion data that could be used with the rail instrumentation and controls system to temporarily shut down the LOSSAN rail operations during or after an earthquake. The system would then be inspected for damage due to ground motion and/or ground deformation and then returned to service when appropriate.

This type of seismic protection is already used for many rapid transit systems in seismically active areas and has been proven effective.

B. FAULT CROSSINGS

The potential for ground rupture along active faults is one of the few geologic hazards that can rarely be fully mitigated. However, known active faults are typically monitored, and in some cases fault creep is mitigated with routine maintenance, which could include minor track re-alignment. Project design could provide for the installation of early warning systems triggered by strong ground motion associated with ground rupture. Linear monitoring systems such as time domain reflectometers (TDRs) could be installed along rail lines within the zone of potential ground rupture. These devices emit electronic information that is processed in a centralized location and could be used to temporarily control trains, thus reducing accidents.

C. SLOPE STABILITY/LANDSLIDES

The potential for failure of natural and/or temporary construction slopes and retention structures can be mitigated through geotechnical investigation and review of proposed earthwork and foundation excavation plans and profiles. Based on investigation and review, recommendations would be provided for temporary and permanent slope reinforcement and protection, as needed. These recommendations would be incorporated into the construction plans. Additionally, during construction, geotechnical inspections would be performed to verify that no new, unanticipated conditions are encountered, and to verify the proper incorporation of recommendations. Slope monitoring may also be incorporated in final design where warranted.

D. AREAS OF DIFFICULT EXCAVATION

The potential for difficult excavation in areas of hard rock and faults cannot be fully mitigated, but it can be anticipated so that safety is assured, potential environmental impacts are addressed, and project schedule problems are avoided to the extent possible. This includes focusing future geotechnical engineering and geologic investigations in these areas and incorporating the findings into project construction documents, communicating with the contractors during the bid process, and monitoring actual conditions during and after construction.

E. HAZARDS RELATED TO OIL AND GAS FIELDS

Hazards related to potential migration of hazardous gases due to the presence of oil fields, gas fields, or other subsurface sources can be mitigated by following strict federal and state Occupational Safety & Health Administration (OSHA/CalOSHA) regulatory requirements for excavations, and consulting with other agencies as appropriate, such as the California Department of Conservation (Division of Oil and Gas) and the California Department of Toxic and Substances Control regarding known areas of concern. Mitigation measures would include using safe and explosion-proof equipment during construction and testing for gases regularly. Active monitoring systems and alarms would be required in underground construction areas and facilities where subsurface gases are present. Gas barrier systems have also been used effectively for subways in the Los Angeles area. Installing gas detection systems can monitor the effectiveness of these systems.

F. MINERAL RESOURCES

Although no mineral resources sites were identified in the study area, more detailed investigation would be conducted at the project level. In some cases, mineral resources sites may represent valuable sources of materials that should either be completely developed prior to use for another purpose or should be avoided by proposed facilities to the extent feasible. This practice could result in realignment of proposed alignments and/or proposed relocation or modification of proposed stations or expansion areas at existing stations. To mitigate the potential for significant project redesign, important mineral sites should be identified as early as possible.

3.11.5 Subsequent Analysis

More detailed geological studies would be required at the project level, and would likely include subsurface exploration, laboratory testing, and engineering analyses to support detailed alignment design and mitigation of potential impacts associated with geologic and soils conditions, including seismic hazards.

3.12 HYDROLOGY AND WATER RESOURCES

This section addresses three types of hydrology and water resources – floodplains, surface water, and groundwater – that have the potential to be affected by the proposed alternatives. In addition, water quality issues are briefly addressed in relation to surface and groundwater resources. The section describes the existing hydrologic resources within the LOSSAN region and generally identifies the potential for impacts on those resources from the No Project and Rail Improvements Alternatives and from rail alignments and station options. The analysis identifies the number and general extent of areas of hydrologic resources that potentially would be affected by the various alignment options for purposes of comparison.

3.12.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Several federal and state laws regulate and are designed to protect hydrologic resources, floodplains and water quality. Below is a list of these statutes. (See Appendix 3.12-A for brief descriptions of these authorities.)

Federal Laws and Regulations

Clean Water Act (33 U.S.C. §§ 1251 et. seq.): The purpose of the Clean Water Act (CWA) is to provide guidance for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters through prevention and elimination of pollution. The CWA applies to discharges of pollutants into waters of the U.S. The following CWA sections are most relevant to this analysis.

- Section 401 of the CWA requires that an applicant for a federal license or permit that allows activities resulting in a discharge to waters of the U.S. obtain a state certification that the discharge complies with other provisions of the CWA. The California Water Resources Control Board (CWRCB) administers the certification program within California through its nine Regional Water Quality Control Boards (RWQCBs).

- Section 402 of the CWA established a permitting system for the discharge of any pollutant (except dredged or fill materials) into the waters of the U.S.

- Section 404 of the CWA established a permit program, administered by the USACE, regulating discharge of dredged or fill materials into waters of the U.S., including wetlands. Implementing regulations by the USACE are found at 33 CFR Parts 320-330. Guidelines for implementation are referred to as the Section 404(b)(1) Guidelines that were developed by the United States Environmental Protection Agency (EPA) in conjunction with the USACE (40 CFR Part 230). The Guidelines allow the discharge of fill materials into the aquatic system only if there is no practicable alternative that would have less adverse impacts.

<u>Section 10 of the Rivers and Harbors Act (33 U.S.C. §§ 401 *et seq.*)</u>: Section 10 of the Rivers and Harbors Act, administered by the Corps, requires permits for all structures (such as riprap) and activities (such as dredging) in navigable waters of the U.S.

<u>Executive Order 11988 — Floodplain Management (U.S. DOT Order 5650.2; 23 C.F.R. 650, Subpart A)</u>: Executive Order 11988 directs federal agencies to avoid to the extent

practicable and feasible short- and long-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Department of Transportation (DOT) Order 5650.2 implements the Executive Order for DOT programs. 23 C.F.R. 650 prescribes Federal Highway Administration (FHWA) policies and procedures for the location and hydraulic design of highway encroachments on floodplains.

Flood Disaster Protection Act (42 U.S.C. §§ 4001-4128; DOT Order 5650.2, 23 C.F.R. 650 Subpart A; and 23 C.F.R. Part 771): The purpose of the Flood Disaster Protection Act is to identify flood-prone areas and provide flood insurance to residents and businesses in those areas.

State Laws and Regulations

California Department of Fish and Game Code (Sections 1601-1603 [Streambed Alteration]): Under Sections 1601-1603 of the Fish and Game Code, agencies are required to notify the California Department of Fish and Game (CDFG) prior to implementing any project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake.

Porter-Cologne Water Quality Act (Water Code Section 13000 *et seq.*): The Porter-Cologne Act is the basic water quality control law for California, and it provides for the CWRCB to implement the CWA for California.

B. METHOD OF EVALUATION OF IMPACTS

Potential impacts on hydrologic resources, floodplains and water quality were evaluated using a combination of both qualitative and quantitative assessment methods. The existing conditions as described for the No Project Alternative provide the primary basis of comparison.

Qualitative Assessment

A qualitative assessment was used to compare the alternatives and alignment options when discussing issues such as runoff, sedimentation, potential for impacts to groundwater, or other items that would ultimately require a more detailed analytic approach (i.e., at the project level, if the decision is made to proceed with the proposed Rail Improvements Alternative) than appropriate for a program-level analysis. For these items, the differences in impacts between alternatives, and among alignment options, are explained in general, qualitative terms.

Quantitative Assessment

For the quantitative assessment, readily available information on wetland areas, stream locations, existing water quality problem areas, flood zones, and general soil information was used to estimate the magnitude of the potential area of impacts for the alternatives. The following steps were completed to estimate the potential areas of impacts for floodplains and water quality from the No Project and Rail Improvements Alternatives.

- Acreage of floodplains in the study area defined as Special Flood Hazard Areas (SFHAs), as defined by the Federal Emergency Management Agency (FEMA) on

Flood Insurance Rate Maps, was identified and estimated to evaluate the area of floodplain potentially impacted by the alternatives.

- Acreage of surface waters (lakes or lagoons) and the linear feet of surface waters (rivers and streams) in the study area was estimated, using U.S. Geological Survey (USGS) 1:24,000 scale digital line graphs of blueline streams, including ephemeral streams. The linear feet of surface water was calculated based on the flow-path length of rivers and streams in the study area to evaluate areas potentially affected by the alternatives. Lake/lagoon surface areas represent the impoundment at maximum capacity.
- Waters with impaired water quality in the study area, (i.e., waters identified on the Section 303(d) CWA list, distributed by the CWRCB), were identified.
- Acreage of areas of potential soil erosion in the study area was estimated to evaluate areas potentially affected by the alternatives. The calculations included those areas with a combination of erosive soils and steep slopes, evaluated as the product of kfact and slopeh (listed in the State Soil Geographic-STATSGO GIS database). Those conditions where kfact x slopeh is greater than 3.0 are potentially susceptible to erosion. Kfact designates the soil erodibility factor (including rock fragments) and slopeh indicates the soil slope.

The quantities of each type of hydrologic resource that could fall in the study area of the Rail Improvements Alternative were estimated based on these steps.

3.12.2 Affected Environment

A. STUDY AREA DEFINED

The study area for hydrology and water quality is defined as the area within 100 ft (30 m) of the centerline of the proposed Rail Improvements Alternative alignment options, and within 100 ft (30 m) of the direct footprint of proposed new or expanded station facilities.

B. HYDROLOGIC RESOURCES IN THE STUDY AREA

Floodplains

Floodplains are land next to a river that becomes covered by water when the river overflows its banks. FEMA designates and maps floodplains. In support of the National Flood Insurance Program (NFIP), FEMA has undertaken flood hazard identification and mapping to produce Flood Hazard Boundary Maps, Flood Insurance Rate Maps, and Flood Boundary and Floodway Maps. The zone of interest for the analysis of hydrologic resources in this program-level evaluation is defined as a special flood hazard area (SFHA) or Zone A, which is the flood insurance rate zone that corresponds to the 100-year flood hazard area in the hydrologic resource study area.

Floodplains are important because they provide floodwater storage and attenuate the risk of downstream flooding, typically provide important habitat for native species (discussed in Section 3.13, Biological Resources and Wetlands), improve water quality by allowing filtration of sediments and other contaminants, and may provide locations for groundwater recharge.

Floodplains encompass floodways, which are the primary areas that convey flood flows. Floodways are typically channels of a stream, including any adjacent areas. NFIP has introduced the concept of floodways and floodplains to assist local communities in floodplain management. The floodway is the channel of a stream, including any adjacent floodplain areas that must be generally kept free of encroachment so that the 100-year flood can be carried without substantial increases to flood heights. The area between the floodway and the 100-year floodplain boundary is referred to as the floodway fringe. Any approved encroachment may take place within the floodway fringe. According to guidelines established by FEMA, increase in flood height in the floodway due to any encroachment in the floodway fringe areas may not exceed 12 in. (30.48 cm), provided that hazardous velocities are not produced in the water body. Constructing levees, rail and road embankments, buildings, etc., that encroach on floodplains may reduce the flood-carrying capacity and increase flood elevations.

Figure 3.12-1 shows SFHAs in the general vicinity of the hydrologic resources study area. As delineated by FEMA, 100-year floodplains in the study area are associated with significant drainage channels or riparian areas just south of Anaheim, or are within coastal areas just south of Camp Pendleton to San Diego.

Surface Waters

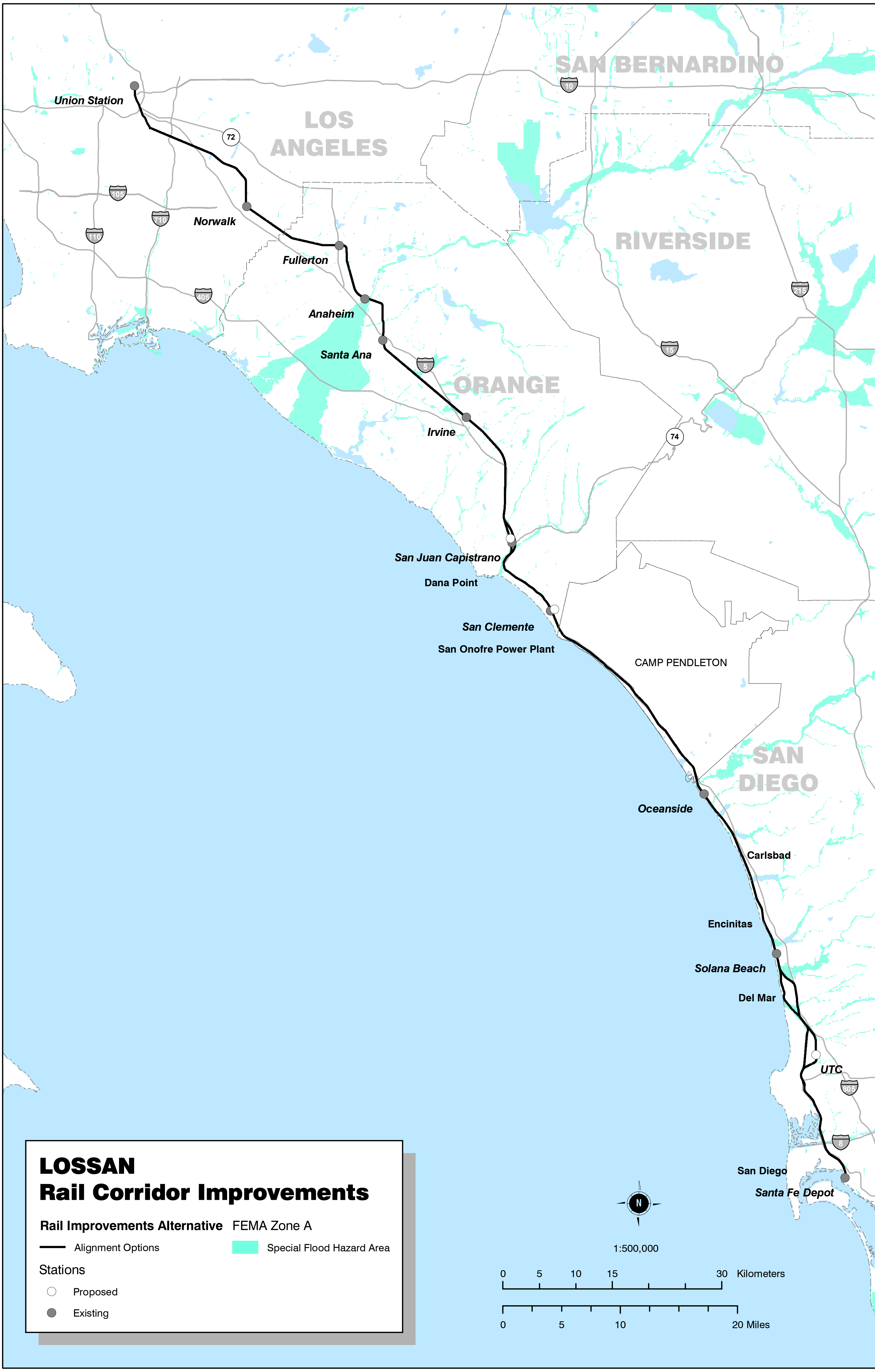
For this analysis, surface waters include improved flood control or drainage channels, intermittent river and stream channels, permanent river and stream channels, ponds, lakes, reservoirs, coastal estuaries and lagoons, and sloughs.

Streams and lakes are important for fish and wildlife, for water supply, and because they convey floodwaters and may contribute to or attenuate the risk of downstream flooding. They provide important habitat for native species and may support wetland and riparian habitats (discussed in Section 3.13, Biological Resources and Wetlands); provide direct pathways connecting to downstream ecological or human resources; and provide locations for groundwater recharge.

Lagoons and estuaries are sheltered, semi-enclosed, brackish bodies of water along shorelines where fresh and salt waters interface through tidal flows and currents. Pollution from storm water runoff, industrial discharges, and boats can damage these resources, especially if their tidal flow is limited, naturally or otherwise. The amount, frequency, duration, and quality of freshwater flows affect the salinity levels, which in turn dictate the types of biological resources associated with a particular water body.

Figure 3.12-2 shows surface waters in the general vicinity of the hydrologic resources study area. (See Section 3.13, Biological Resources and Wetlands, for a discussion of wetlands.) The major rivers and channels in the region include Los Angeles, Rio Hondo, San Gabriel, Santa Ana, Santa Margarita, San Luis Rey, San Dieguito, and San Diego Rivers. Other water resources include the San Diego and Mission Bays which border the southern end of the study area, and the coastal lagoons located in northern San Diego County.

The existing LOSSAN railroad corridor generally parallels the coastline between Capistrano Beach and San Diego. Along this stretch of coast, six lagoons have formed where streams flow into the Pacific Ocean: Buena Vista, Agua Hedionda, Batiquitos, San Elijo, San Dieguito, and Los Peñasquitos. These lagoons contain a mixture of salt and fresh water, and the water level is often influenced by tidal cycles.



Source : USGS, 1998

FIGURE 3.12-1

Special Flood Hazard Areas

LOSSAN Rail Corridor Improvements

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U.S. Department of Transportation
Federal Railroad Administration
Caltrans

Key to Surface Waters

Name	Number	CWA 303(d)
Batiquitos River	1	
Brea Creek	2	
Carbon Creek	3	
Coyote Creek	4	Yes
Fullerton Creek	5	
La Mirada Creek	6	
Loma Alta Creek	7	Yes
Los Angeles River	8	Yes
Los Penasquitos Canyon Creek	9	
Los Penasquitos River	10	
Mission Bay	11	
Oso Creek	12	
Peters Canyon Wash	13	Yes
Rio Hondo River	14	Yes
San Diego Bay	15	
San Diego Creek Channel	16	
San Diego River	17	Yes
San Dieguito River	18	
San Elijo River	19	
San Gabriel River	20	Yes
San Juan Creek	21	Yes
San Luis Rey	22	Yes
San Mateo Creek	23	
San Onofre Creek	24	
Santa Ana River	25	Yes
Santa Margarita River	26	Yes
Santiago Creek	27	Yes
Soledad Creek	28	
Tecolote Creek	29	Yes
Trabuco Creek	30	
Lagoons		
Agua Hedionda Lagoon		Yes
Batiquitos Lagoon		Yes
Buena Vista Lagoon		Yes
Los Peñasquitos Lagoon		Yes
San Dieguito Lagoon		Yes
San Elijo Lagoon		Yes

Source : USGS, 1998

U.S. Department of Transportation
Federal Railroad Administration

FIGURE 3.12-2
Surface Waters
LOSSAN Rail Corridor Improvements
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When the rail corridor across the lagoons was originally established, the tracks were typically built on an earth-fill embankment. A relatively short bridge allowed for water to pass under the tracks, but the embankment reduced the degree of water circulation in the lagoon. Where previously the stream channel may have meandered across the lagoon, the opening to the ocean was now fixed at the bridge location. After the railroad was constructed, the old Coast Highway was constructed nearly parallel to the railroad tracks. In most of these lagoons, the highway was also built on an earth-fill embankment, with a bridge opening in line with the railroad bridge opening.

Groundwater

Groundwater is found in subsurface water-bearing formations. A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers. Groundwater basins, which do not necessarily coincide with surface drainage basins, are defined by surface features and/or geological features such as faults, impermeable layers, and natural or artificial divides in the water table surface. The elevation of groundwater varies with the amount of withdrawal and the amount of recharge to the groundwater basin. Groundwater basins may be recharged naturally as precipitation infiltrates, and/or artificially with imported or reclaimed water. Shallow groundwater is subject to potential impacts from dewatering during construction.

The California Coastal Basin Aquifer is the primary aquifer identified in the LOSSAN region. Figure 3.12-3 shows the location and extent of this aquifer within the general vicinity of the hydrologic resources study area. Groundwater depth within the region varies from a few feet to more than 100 ft (30 m). Perched aquifers with a shallow water surface occur throughout Los Angeles and Orange Counties. Shallow groundwater is also likely adjacent to or in the vicinity of streams, rivers, lagoons and bays.

Two varieties of groundwater are found along the proposed coastal routes. The first is perched water, which infiltrates and percolates through the sandy terraces, then becomes perched on or within less porous bedrock units. This contributes to the instability of the Del Mar and San Clemente coastal bluffs. Efforts to control the instability have included improvements to the storm drain system, surface drainage, and sub-drains. The second variety of groundwater is subsurface water that saturates surface and formational materials in the vicinity of alluvial or estuarine environments, such as the mouths of the major drainage areas and lagoons.

C. WATER QUALITY

Surrounding land uses affect surface water and groundwater quality. Both point-source[1] and nonpoint-source[2] discharges contribute contaminants to surface waters. Pollutant sources in the primarily urban areas of the LOSSAN region include parking lots and roadways, rooftops, exposed earth at construction sites, and landscaped areas.

The impacts of nonpoint-source pollutants on aquatic systems are many and varied. Polluted runoff waters can result in impacts on aquatic ecosystems, public use, and

[1] *Point source* is a stationary location or fixed facility, such as the end of a pipe, from which pollutants are discharged; any single identifiable source of pollution (EPA 2002).

[2] *Nonpoint source* pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA 2002).

human health from ground and surface water contamination, damage to and destruction of wildlife habitat, decline in fisheries, and loss of recreational opportunities. Small soil particles washed into streams can smother spawning grounds and marsh habitat. Suspended small soil particulates can restrict light penetration into water and limit photosynthesis of aquatic biota. Metals and petroleum hydrocarbons washed off of roadways and parking lots, and fertilizers, pesticides, and herbicides from landscaped areas may cause toxic responses (acute or long term) in aquatic life, or may harm water supply sources such as reservoirs or aquifers.

Erosion

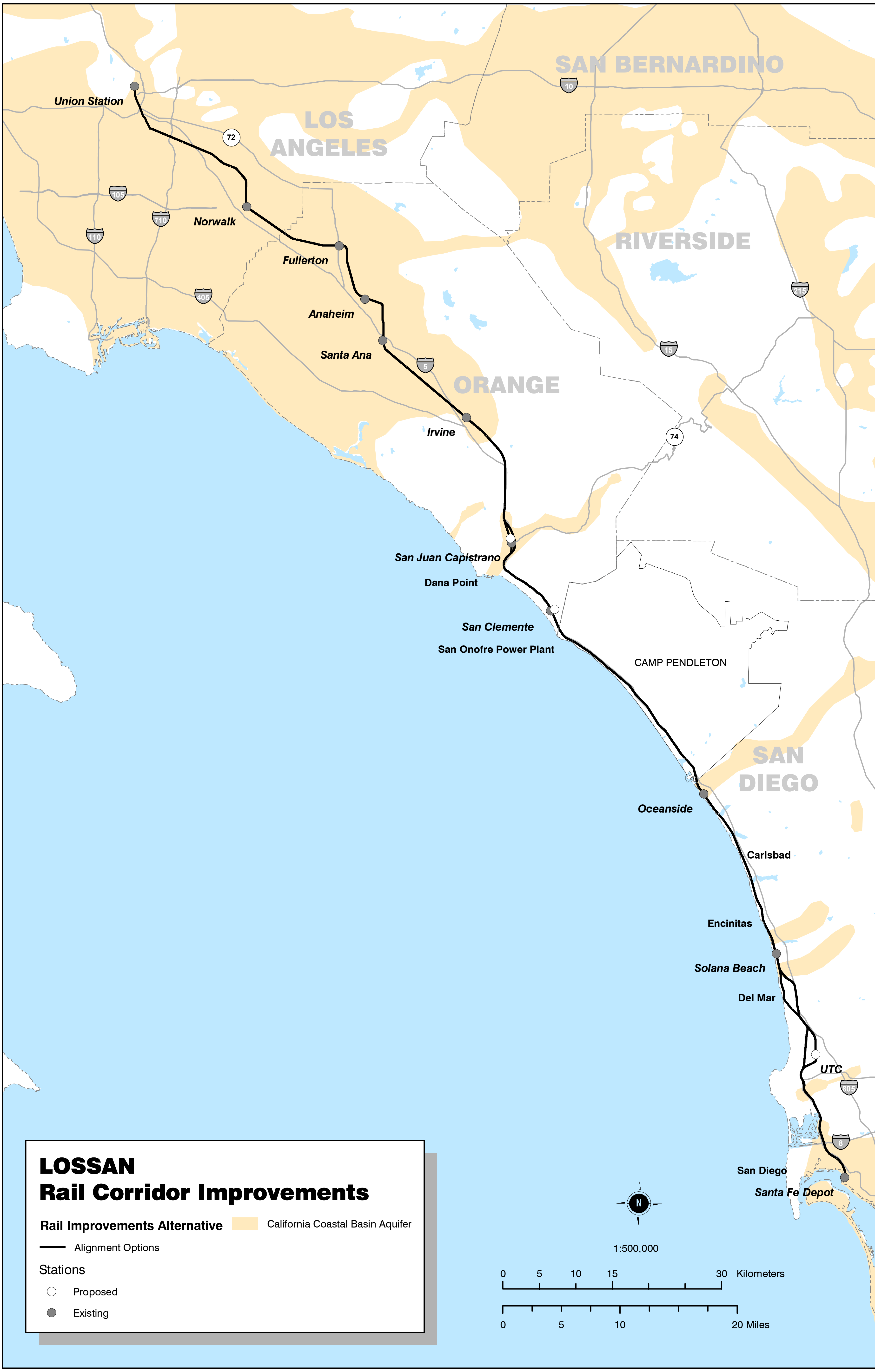
Potential impacts on water quality may result from construction activity (e.g., grading, which removes vegetation, exposing soil to wind and water erosion). A potential erosive condition occurs in areas with a combination of erosive soil types and steep slopes. Erosion can result in sedimentation that ultimately flows into surface waters. Contaminants in runoff waters may include sediment, hydrocarbons (e.g., fuels, solvents, etc.) metals, pesticides, bacteria, nutrients, and trash. Figure 3.12-4 shows areas with soils susceptible to erosion in the general vicinity of the hydrologic resources study area.

Impaired Waters

Some water bodies have been given special status under the CWA. Section 303(d) of the CWA requires each state to identify waters that will not achieve water quality standards after application of effluent limits, and to develop plans for water quality improvement. For each water body and pollutant for which water quality is considered impaired, the state must develop load-based (as opposed to concentration-based) limits called total maximum daily loads (TMDLs). TMDL is the maximum amount of pollution (both point and non-point sources) that a water body can assimilate without violating state water quality standards. Priorities for development of TMDLs are set by the state, based on the severity of the pollution and the beneficial uses of the waters. The EPA TMDL program provides a process for determining pollution budgets for the nation's most impaired waters. Pollutant loading limits are set and implemented by the CWRCB under the Porter-Cologne Act. The program includes development of water quality standards, issuance of permits to control discharges, and enforcement action against violators.

Water bodies with impaired water quality in the LOSSAN region include the Los Angeles, Rio Hondo, San Gabriel, Santa Ana, Santa Margarita, and San Luis Rey Rivers. (Refer to Figure 3.12-2.) The rivers are considered impaired because they exceed standards for algae, ammonia, metals, chloroform count, pesticides, nutrients, toxicity, trash, and/or sedimentation. In San Diego County, the lagoons and the San Diego and Mission Bays are also considered impaired because of declining water quality, increased freshwater input, accumulated sediment, diminished biological productivity, and water circulation constraints.

The water bodies that are tributaries of or discharge into 303(d) impaired waters include Batiquitos River, Los Peñasquitos Canyon Creek, Los Peñasquitos River, San Diego Creek Channel, San Diego River, San Dieguito River, San Elijo River, Santiago Creek, and Soledad Creek. Since these are tributaries of or discharge into 303(d) waters, they may be considered part of the 303(d) listed water bodies.



Source : USGS, 1998

FIGURE 3.12-3
Groundwater
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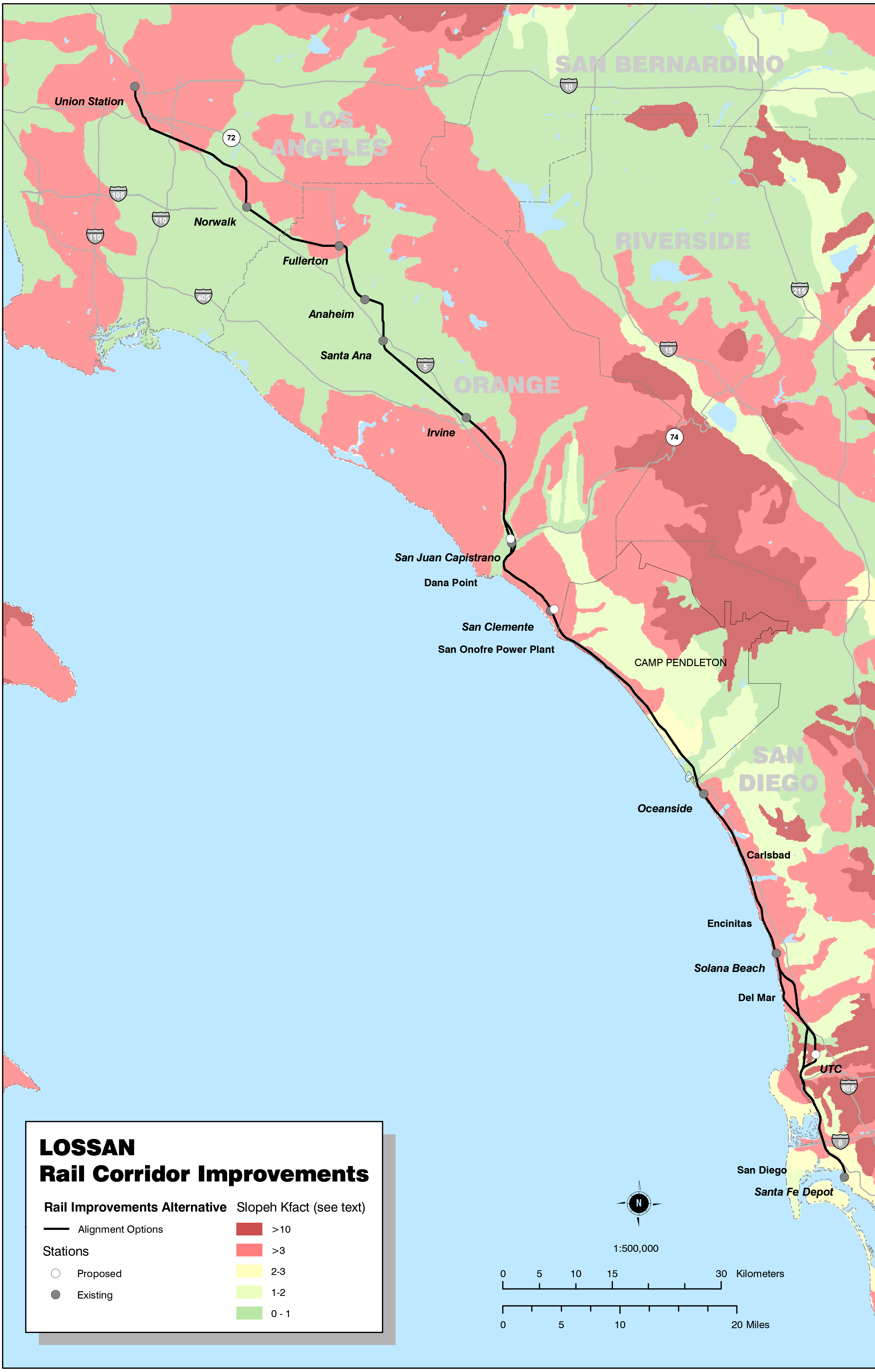

Source : Jennings, 1977

U.S. Department of Transportation Federal Railroad Administration

FIGURE 3.12-4
Areas Susceptible to Erosion
LOSSAN Rail Corridor Improvements
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3.12.3 Environmental Consequences

Potential impacts on hydrology and water resources which may result from the No Project Alternative or the proposed Rail Improvements Alternative include potential encroachment on or location in a floodplain, potential impacts to water quality, potential increased or decreased runoff and stormwater discharge due to changes in the amount of paved surface, potentially increased or decreased contribution of nonpoint-source contamination from automobiles, potential impacts on groundwater from dewatering or reduction of groundwater recharge, or impediments to tidal flow at lagoon crossings.

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

In addition to existing conditions, the No Project Alternative includes planned and programmed transportation improvements that would be constructed and operational by 2020. The potential impacts of the No Project Alternative on hydrologic resources and water quality are assumed to be limited because typical design and construction practices would need to meet permit conditions. However, some impacts to hydrologic resources would likely result from the implementation of the projects under the No Project Alternative, such as increased runoff from added lanes of paved surface and new columns for expanded roadway or railway bridges over rivers, streams, and lagoons. However, attempting to estimate these potential impacts would be speculative. Project-level environmental documents and permit applications would in all likelihood be prepared by project proponents for future projects that would affect hydrologic resources and water quality. These project-level documents would identify, analyze, and avoid, minimize, or mitigate potential impacts to hydrology and water quality to the extent feasible. Therefore, it is assumed that few major changes would occur to hydrologic resources as a result of No Project Alternative and that existing conditions can serve as the basis for assessment of the potential for impact from the Rail Improvements Alternative.

Beyond the potential impacts for programmed improvements (to be addressed in other project-level documents), the No-Project Alternative potentially would have additional, indirect impacts on hydrologic resources and water quality in the coastal bluff areas along the LOSSAN corridor. The No-Project Alternative would not provide any opportunity for long-term solutions to the continued erosion problems along the existing LOSSAN rail corridor in the San Clemente and Del Mar coastal bluff areas, caused by wave action, groundwater infiltration, and slope stability. The No Project Alternative would result in the need for the bluffs to be stabilized over the long-term, and drainage facilities maintained or increased, to continue reliable rail service in these areas.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

The estimated areas of potential impacts to hydrologic resources and water quality would not provide a primary means of differentiating between the alternatives or among the rail improvement alignment options because neither alternative nor any of the alignment options presents significant potential impacts that could not be substantially avoided, minimized, or mitigated through conventional design and construction processes, and compliance with permits and Best Management Practices (BMPs) that are required for project permits. For example, it is expected that streams and rivers would largely be spanned by bridges (culverts also can be used) or tunneled under to minimize potential impacts to the flow and water quality of these hydrologic resources. Further, potential impacts on water quality from surface runoff or erosion during project construction would be identified during the project-level analysis and the design phase, and standard BMPs would be used to minimize potential impacts. The primary difference among alignment options would be the cost to bridge over streams and rivers and tunnel under waters and wetland areas or construct elevated rail infrastructure to minimize potential impacts to surface flow.

Areas with identified sensitive habitat, such as the tidal lagoons in northern San Diego County, are discussed in Section 3.13, Biological Resources and Wetlands, of this Program EIR/EIS. These areas have waters and wetlands that provide potential habitat to special-status species. Avoiding or minimizing impacts on hydrologic resources and riparian corridors would be a factor in selecting a least environmentally damaging practicable alternative.

Potential hydrology and water quality impacts related to construction could result from ground-disturbing activities at shafts, portals, and staging areas; generation of spoils; construction phase vibration and noise; and potential ground surface settlement from trenching/tunneling and excavation. These impacts would be temporary, and would abate as construction is completed and revegetation or surface stabilization measures are put in place.

Overall, it is anticipated that operational activities could have a beneficial effect on hydrology and water quality impacts. Implementation of alignment options that would modify existing bridge structures across lagoons would allow for improved tidal flushing, improving the quality of the water. Also, the rail corridor expansion would likely reduce vehicular miles traveled on the area freeways which would reduce the pollutant load in runoff and reduce or slow increases in potential water quality impacts. Options that would remove the existing rail corridor from coastal bluff areas in San Clemente and Del Mar would reduce long-term bluff erosion and reduce potential impacts from increased storm surge and rising sea levels along the coastal rail route.

Table 3.12-1 summarizes the potential area of impacts on the various hydrologic resources examined as part of this evaluation. Potential impacts of the various alignment options are described below by resource.

Table 3.12-1
Summary of Hydrologic Resources Potentially Impacted

Rail Improvement Alignment Options	**100-Year Floodplains** Acres (Hectares)	**Streams and Rivers** Linear Feet (Meters)	**Lakes and Lagoons** Acres (Hectares)	**High Potential for Erosion** Acres (Hectares)	**Potential for Impact to Groundwater** (H, M or L)
Union Station To Fullerton Station – 4th Main Track	10 (4)	675 (203)	0	220 (89)	L
Fullerton Station To Irvine Station—Double Tracking					
AT-GRADE between Orange and Santa Ana	65 (26)	2,590 (777)	0	20 (8)	L

Table 3.12-1
Summary of Hydrologic Resources Potentially Impacted (continued)

Rail Improvement Alignment Options	**100-Year Floodplains** Acres (Hectares)	**Streams and Rivers** Linear Feet (Meters)	**Lakes and Lagoons** Acres (Hectares)	**High Potential for Erosion** Acres (Hectares)	**Potential for Impact to Groundwater** (H, M or L)
TRENCH between Orange and Santa Ana	65 (26)	2,590 (777)	0	20 (8)	L (at-grade sections) M (trench sections)
Stations Fullerton	0	0	0	15 (6)	
Anaheim	15 (6)	0	0	0	
Santa Ana	0	0	0	0	
Irvine	5 (2)	0	0	0	
San Juan Capistrano Double Tracking					
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	25 (10)	1,195 (359)	0	35 (14)	L (at-grade sections) M (tunnel sections)
AT-GRADE and Cut/Cover TRENCH along east side of Trabuco Creek	5 (2)	2,340 (702)	0	5 (2)	L
Stations San Juan Capistrano	0	0	0	0	L
Dana Point/San Clemente Double Tracking					
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	30 (12)	740 (222)	0	235 (95)	L (at-grade sections) M (trench sections)
San Clemente - LONG TWO-SEGMENT TUNNEL	0	340 (102)	0	240 (97)	L (tunnel sections) M (trench sections)
Stations San Clemente	5 (2)	0	0	0	L
Camp Pendleton At-grade Double Tracking	0	940 (282)	0	0	L
Oceanside/Carlsbad Double Tracking					
Carlsbad - AT-GRADE; double tracking	15 (6)	1,300 (390)	7 (3)	95 (38)	L
Carlsbad -TRENCH; double-tracking	15 (6)	1,300 (390)	7 (3)	95 (38)	L
Stations Oceanside	0	0	0	5 (2)	L
Encinitas/Solana Beach Double Tracking					
Encinitas - AT-GRADE;	20 (8)	1,615 (485)	3 (1)	160 (65)	L
Encinitas - SHORT TRENCH	20 (8)	1,615 (485)	3 (1)	160 (65)	M

Table 3.12-1
Summary of Hydrologic Resources Potentially Impacted (continued)

Rail Improvement Alignment Options	**100-Year Floodplains** Acres (Hectares)	**Streams and Rivers** Linear Feet (Meters)	**Lakes and Lagoons** Acres (Hectares)	**High Potential for Erosion** Acres (Hectares)	**Potential for Impact to Groundwater** (H, M or L)
Stations Solana Beach	0	0	0	15 (6)	L
Del Mar Double Tracking					
TUNNEL under Camino Del Mar	75 (30)	1,310 (393)	2	140 (57)	L (tunnel sections) M (trench sections)
TUNNEL along I-5	35 (14)	1,520 (456)	0.5	145 (59)	L
I-5/805 Split To Hwy 52 Double Tracking					
Miramar Hill TUNNEL	15 (6)	455 (137)	0	35 (14)	L
I-5 TUNNEL	35 (14)	320 (96)	0	30 (12)	L
Stations UTC (Only applies to Miramar Hill Tunnel)	0	0	0	25 (10)	L
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	15 (6)	1,475 (443)	0	75 (30)	L (at-grade sections) M (trench sections)
Stations Santa Fe Depot	0	0	2* (0.8)	0	L

*Adjacent to San Diego Bay but does not cross.

Floodplains

Potential flood impacts may occur in areas where designated SFHAs were identified along the rail routes. Depending on the alignment option, the total extent of SFHAs crossed in the study area ranges from a low of approximately 205 ac (83 ha) to a high of 315 ac (127 ha). Floodplain impacts are expected to be low overall, because many of the proposed improvements would be done within the established LOSSAN rail corridor designed in the floodplains, or would involve deep tunnels that would avoid surface floodplains.

From Union Station to Irvine, SFHAs would be equally affected by either alignment option along the existing LOSSAN rail alignment. Proposed modifications at the existing Anaheim and Irvine Stations would affect SFHAs and potential flood impacts could occur. Because the modifications would involve parking expansion and bypass tracks at existing stations, it is expected that any potential flood hazard can be avoided or mitigated through planning and design.

The City of San Juan Capistrano rail improvement options include the I-5 tunnel option, and an at-grade and trenched option east of Trabuco Creek. Designated SFHAs would be crossed along the at-grade portions of the tunnel option, and for a short length of the Trabuco Creek option. There is a potential for flood impacts to the western bank of

Trabuco Creek if the trench were designed with the eastern stream bank serving as the trench wall. This could result in hard-armoring of the eastern bank which could then cause damage to the western bank and possibly the rail corridor itself during flood events.

SFHAs have been identified in areas along the Dana Point curve realignment and within the short tunnel option south of the curve realignment. The long, two-segment tunnel alignment does not cross any known SFHAs.

Between Oceanside and San Diego, most segments and options would encompass SFHAs, including the trench and at-grade options in Carlsbad and Encinitas, and both tunnel options in Del Mar. The tunnel alignment under Camino del Mar crosses about 75 ac (30 ha) of SFHA, while the I-5 tunnel option crosses about 35 ac (14 ha); however, most of the potential floodplain impacts along either of these alignments would be avoided by tunneling. Similarly, the two tunnel options south of the I-5/805 Split both encounter floodplains, but would not be expected to have a substantive impact due to the depth of the tunneling. Small areas of SFHAs are also present along the alignment from Highway 52 to the Santa Fe Depot in San Diego where there is some potential for impact along the proposed at-grade and trenched alignment.

Surface Waters

Between Los Angeles Union Station and San Diego Santa Fe Depot, the various rail alignment options cross approximately 25 streams and rivers, 13 of which are 303(d) waters. In addition, these rail options cross six coastal lagoons in northern San Diego County, all of which are considered impaired waters. Depending on the alignment options, a total of between 11,760 and 13,650 linear ft (3,528 to 4,095 m) of streams and rivers are within the study area potentially affected, and between 10.5 and 12 ac (4 to 5 ha) of lagoons are within the study area potentially affected.

During project scoping, the Department stated that project design for the Rail Improvements Alternative would be such that, at a minimum, there would be no net increase in the existing footprint of the rail infrastructure or fill in the coastal lagoons. This design commitment would prevent any further reduction in water circulation attributable to the railroad infrastructure.

There is a potential for improving the existing hydrologic conditions in the lagoons, if the existing earth-fill embankments were replaced with new causeway structures, and/or existing bridge spans were widened. The feasibility, costs versus benefits, and effectiveness of improving hydrologic conditions by replacing structures cannot be fully assessed at this program-level evaluation. Those issues would be examined in more detail during project-level analyses (see Section 3.12-5 below).

In San Juan Capistrano, the tunnel option along I-5 would potentially affect fewer surface water resources than the at-grade and trenched alignment option on the east side of Trabuco Creek. The latter would pose potential sedimentation impacts during construction from erosion and run-off.

In the Dana Point/San Clemente area, the short-tunnel option would have somewhat higher potential for impacts on surface water than the long, two-segment tunnel option, because the short option would involve more at-grade and trenched construction.

In the Del Mar area, the Camino del Mar tunnel option would result in removal of the existing rail corridor from the coastal bluffs, placing it in a tunnel, and crossing two lagoons on elevated (bridge) structures. The existing rail bridge across the Los Peñasquitos Lagoon would likely be replaced with a new bridge or causeway structure that would eliminate the existing fill and increase water circulation and tidal flushing. The San Dieguito Lagoon crossing would remain within the footprint of the existing rail structure. The I-5 tunnel would also remove the existing tracks from the coastal bluffs, placing them in a tunnel and bypassing Los Peñasquitos Lagoon. This tunnel would surface at the southern edge of San Dieguito Lagoon and a new bridge would cross the floodplain and river of this lagoon. Either of the tunnel options in the Del Mar area would result in a temporary increase in sedimentation in the two lagoons during construction and/or removal of the existing Los Peñasquitos bridge structure.

Water quality during operation of any of the design options could improve from the existing condition with the reduction in vehicle miles traveled on area highways. Fewer roadway pollutants would be present in the surface run-off from the roadways. This beneficial effect could be particularly helpful in reducing or slowing the further impairment of 303(d) waters in the project area. Another potential improvement to surface waters could occur in areas where mitigation may include new bridge designs over lagoons and other water bodies that would allow for better water circulation and tidal flushing.

Storm Water/Run-off

Storm water run-off from the proposed improvements would be generated during both construction and operation. Common sources of storm water pollution during construction would include equipment and vehicle leaks of oil, grease, fuel, etc., construction materials, and waste material.

Impacts associated with operational storm water run-off are anticipated to be minimal because the Rail Improvements Alternative would add very little new impervious surface. Few of the proposed rail improvements would increase existing impervious surfaces by any substantive amount, except the additional parking areas planned for some existing rail stations. The expected reduction in vehicle miles traveled with the implementation of the Rail Improvements Alternative would also reduce (or, at least, slow the increase of) the pollutant burden in storm water run-off from area highways.

Erosion

Available data indicates that soils susceptible to erosion (i.e., with a factor greater than 3.0) are located in a number of areas along the rail corridors. Most erosion potential can be controlled and contained through proper design, pollutant prevention plans, and mitigation. Erosion potential is not expected to be a substantial construction or operation issue in the rail alignments, and it makes no clear differentiation between alignment options in any segment (refer to Table 3.12-1). Any of the options proposed in the San Clemente and Del Mar coastal areas would improve the existing bluff erosion problem, as described earlier under the No-Project Alternative.

Groundwater

Construction methods for the various alignment options between Union Station and San Diego include at-grade, trenching, and tunneling. Groundwater impacts are anticipated to be low for at-grade construction and most tunnel segments, and medium for most trench segments.

Proposed improvements to existing stations are anticipated to have a low impact on groundwater. Potential new stations at San Juan Capistrano (Trabuco Creek design option), San Clemente, and University Town Centre would be depressed below grade. These conceptual station sites are not located in the California Coastal Basin Aquifer area and are not expected to have a substantive impact on groundwater.

Sea Level Rise

The character of the coastline is the result of various natural processes, one of which is rising sea levels. This is a growing concern among coastal communities. It is projected that a rise of 19 in (48 cm), with a possible range of 5 to 37 in (13 to 94 cm) in sea level could occur by the year 2100 (Wilkinson et al. 2002). A rise in sea level would expose the coastline to increased flooding. Impacts from global warming and rising sea levels are not expected to impact the rail improvement options between Union Station and Irvine Station because of their inland location. Impacts from global warming and rising sea levels may impact rail improvements between Irvine Station and San Diego, especially where the improvements are in close proximity to the shoreline.

Rising water levels would have a direct impact on beach erosion, which, in turn, could undermine storm protection structures for the tracks. Sea-level rise and associated erosion, storm surge, and flooding could have a direct impact on at-grade sections of the rail alignments near the shoreline in Encinitas San Clemente, and Del Mar. The design options that would remove the existing rail alignment from the coastal bluffs in San Clemente and Del Mar would reduce the existing potential for impacts of sea-level rise in these areas. Bridge structures across lagoons in northern San Diego County could be adversely affected by increased erosion around the footings due to rising water levels and storm surge.

3.12.4 Mitigation Strategies

Proposed general mitigation strategies would be fairly similar for all rail improvement alignment options. These strategies are described as general policies that could be adopted and developed in detail at the project-specific level of environmental analysis. First, measures designed to avoid or to limit impacts would be considered. If avoidance measures were not feasible, then mitigation measures directed at reconstruction, restoration, or replacement of the resource, in close coordination with state and federal resource agencies, would be considered as part of subsequent project planning, environmental review, and design. Potential mitigation strategies are listed below by resource.

A. FLOODPLAINS

Mitigation for potential impacts on floodplains would include consideration of the following strategies.

- As part of the future project-level analysis, floodplain hydrology/hydraulics would be analyzed to evaluate the impacts of specific designs on water surface elevations and flood conveyance for low frequency floods and to evaluate potential flooding risk. Where feasible, avoid or minimize construction of facilities within floodplains. Where feasible, restore the floodplain if impacted by construction so it can again operate as before. Where there is no practicable alternative to avoid construction in the floodplain, minimize the footprint of facilities within the floodplain, e.g., by use of aerial structures or tunnels.

- As part of the future project-level analysis, all opportunities for facility redesign or modification to minimize flooding risk and potential harm to or within the floodplain would be assessed.

B. SURFACE WATERS, RUNOFF AND EROSION

Mitigation strategies for potential impacts on surface waters would include consideration of the following.

- As part of the future project-level analysis, conduct studies and evaluate potential alteration in coastal hydrology/hydraulics in tidal lagoons from specific construction methods or facility designs. Construction methods or facility designs to minimize potential impacts would be considered and utilized to the extent feasible. (See Section 3.13, Biological Resources and Wetlands, for further mitigation strategies for lagoon areas.)

- Permit requirements as part of project-level review would include Storm Water Pollution Prevention Plans (SWPPP) and National Pollutant Discharge Elimination System (NPDES) permits. The SWPPP would include BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for all stream and lake/lagoon crossings. Regional NPDES permit requirements would be followed and BMPs, as required for new developments, would be implemented. These may include measures to provide permeable surfaces where feasible and to retain and treat stormwater onsite using catch basins and treatment (filtering) wetlands. Other measures to manage the overall amount and quality of stormwater runoff to regional systems would be detailed as part of the SWPPP.

- Apply for and obtain appropriate permits under Sections 404 and 401 of the Clean Water Act and comply with mitigation measures required in the permits. Other mitigation measures may include habitat restoration, reconstruction onsite, or habitat replacement offsite to compensate for loss of native habitats and wetlands. The ultimate goal of the mitigation would be to ensure minimal impact on surface water quality.

C. GROUNDWATER

Mitigation to reduce potential impacts from construction and operation of project components on groundwater discharge or recharge would include consideration of the following strategies.

- As part of the future project-level analysis, minimize development of facilities in areas that may have substantial groundwater discharge or affect recharge.

- Apply for and obtain waste discharge requirements where needed (e.g., for de-watering), as part of project-level review.

- As part of the future project-level analysis, develop facility designs that are elevated or at a minimum are permeable and would not affect recharge potential where construction is required in areas of potentially substantial groundwater discharge or recharge.
- Apply for and obtain a SWPPP under NPDES permit requirements for grading, and describe BMPs that would control release of contaminants near areas of surface water or groundwater recharge (include constraining fueling and other sensitive activities to alternative locations, providing drip pans under some equipment, and providing daily checks of vehicle condition).
- Consider use and retention of native materials with high infiltration potential at the ground surface in areas that are critical to infiltration for groundwater recharge.

3.12.5 Subsequent Analysis

Subsequent analysis to further identify potential impacts on water quality and hydrological resources would be required as project development, environmental review and facility design are pursued, if a decision is made to go forward with the rail improvements. This subsequent analysis may include the following:

- Further analysis and assessment of potential facility impacts on floodplains, specifically on flood elevations, as specific locations and facility designs are developed, to determine if the proposed facility is in the base floodplain (that area which has a one percent or greater chance of flooding in any given year). The analysis would identify potential encroachment on study-area floodplains as defined in Executive Order 11998 for Floodplain Management (23 C.F.R. Section 650(a)) and DOT Order 5650.2, or location of facilities in a 100-year floodplain without adequate mitigation measures.
- Further analysis (hydrologic modeling of flow rates) of potential construction and facility impacts on surface hydrology in coastal areas and tidal marshes and lagoons, and on other surface waters.
- An analysis of potential construction and facility impacts on surface hydrology in areas that are characterized as wetlands and that were not included in this analysis because field verification and wetland delineation was not part of this program-level evaluation. (See Section 3.13, Biological Resources and Wetlands for discussion of wetlands.)
- Field surveys of potential surface water impacts to further analyze potential impacts on water quality and to seek required permits from the appropriate agencies.
- Identification of potentially substantial alteration in water-flow and drainage patterns, including increased storm water runoff, or increased groundwater discharge or reduction of groundwater recharge.
- Evaluation of potential impacts of the design options on groundwater recharge and infiltration systems.
- Identification and study of areas of shallow groundwater to determine possible dewatering impacts resulting from construction.

- Analysis of how the different alignment options would contribute to total additional impervious surface and the subsequent potential additional impacts on surface runoff. This analysis would also identify potential mitigation measures, including onsite retention facilities.
- Field geotechnical studies to evaluate the potential for erosion and associated risks.
- Field surveys of groundwater discharge or recharge conditions. Additional supplemental analysis of groundwater conditions with information from other geotechnical studies.

3.13 BIOLOGICAL RESOURCES AND WETLANDS

This analysis reviews the biological resources and wetlands that may in the future require a permit and Section 404(b)(1) analysis under the federal Clean Water Act for a proposed action, and includes sensitive plant communities and special-status species, marine and anadromous fish habitat, riparian corridors, wildlife habitats, wildlife movement corridors, wetlands, and waters. Appendix 3.13-A provides a general description of these biological resource topics. This section describes the existing sensitive biological resources and wetlands within the LOSSAN Region, and identifies the areas of potential impacts of the Rail Improvement Alternative alignment and station options for these resources.

3.13.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

This section briefly identifies the key federal and state laws and regulations relative to biological resources. Descriptions of these laws and regulations and the agencies responsible for implementing them are provided in Appendix 3.13-B.

Federal Laws and Regulations

- Federal Endangered Species Act (FESA) (16 U.S.C 1531–1543)
- Clean Water Act (33 U.S.C 1251–1376)
- Migratory Bird Treaty Act (16 U.S.C. 703-712)
- Section 10 of the Rivers and Harbors Act (33 U.S.C 401 et seq.)
- Fish and Wildlife Coordination Act (16 U.S.C 661–666)
- Coastal Zone Management Act (16 U.S.C. 1456)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C 1801 et seq.)
- Executive Order 11990, Protection of Wetlands (May 24, 1977), DOT Order 5660.1A
- Executive Order 13112, Invasive Species (February 3, 1999)

State Laws and Regulations

- California Endangered Species Act (CESA) (Fish and Game Code 2050 et seq.)
- Native Plant Protection Act (Fish and Game Code Sections 1900–1913)
- Natural Community Conservation Planning Act (Fish and Game Code Section 2800 et seq.)
- Streambed Alterations (Fish and Game Code Sections 1601–1603)
- California Coastal Act (Public Resources Code section 30000, et seq.)

B. METHOD OF EVALUATION OF IMPACTS

Data Collection and Geographic Information System Mapping

The proposed Rail Improvements Alternative would cross a variety of biotic communities and could potentially result in impacts on many plant and wildlife species, and many water resources. Plant taxonomy and nomenclature follows Abrams (1923, 1944, 1951), Abrams and Ferris (1960), Buckingham et al. (1995), Hickman (1993), and Hitchcock et al. (1996). Scientific nomenclature and common names for butterflies follows Miller (1992); fish, Robins et al. (1991); herpetofauna (amphibians and reptiles), Committee on Standard English and Scientific Names (2001); birds, American Ornithologists' Union (1983, 1998); and mammals, Wilson and Cole (2000).

Geospatial data based on the California Gap Analysis Program (GAP) (Davis 1998), which uses the Wildlife Habitat Relationship (WHR) classification (Ziener et al. 1988; 1990a; 1990b), was used as the primary source for delineation of sensitive vegetation communities along the Rail Improvement Alternative. However, the classification is based on Holland (1986). The most recent vegetation classification for California (Sawyer and Keeler-Wolf 1995) was not used, as this data is not available in geospatial contexts. Geospatial data for threatened and endangered species and special status species was obtained from the California Natural Diversity Data Base (CNDDB) (California Department of Fish and Game 2002). Wildlife movement corridors data were not available for the study area, so this evaluation assumed potential corridors were present in any large open areas, lagoons and surrounding parks and reserve areas, and riparian areas in undeveloped settings.

The type and extent of jurisdictional wetlands within the study areas came from the National Wetland Inventory (NWI) maintained by the U.S. Fish and Wildlife Service (USFWS) to provide information on the characteristics, extent, and status of the nation's wetlands. NWI digital data files are records of wetlands location and classification as developed by the USFWS. The federal Geographic Data Committee adopted this classification system as a national classification standard in 1996. The location of the wetlands is mapped on U.S. Geologic Survey (USGS) 7.5-minute topographic quadrangle maps with codes that provide information on the water body type and substrate. The maps tend to show wetlands that are readily photo-interpreted given consideration of photo and map scale. This level of information, though incomplete for some areas, provides a general overview of areas with potential sensitivity for wetland impacts that is used in the comparison of alternatives and the identification of areas where subsequent field work and wetland delineation would be conducted in the next phase of environmental evaluation, should the Rail Improvement Alternative be carried forward for further analysis. Wetland information is quantified to estimate the approximate acres potentially affected by the alternatives.

Digitized information for vernal pools was obtained from the California Department of Fish and Game (CDFG). There were no geospatial data available for riparian corridors. The presence of streams and corresponding riparian vegetation was developed using USGS quadrangle maps, and geospatial results of the California GAP and CNDDB for specific riparian vegetation polygons.

GIS data was exported to excel spreadsheets to show acreages of attributes for each alignment option. A detailed description of the data collection methods is provided in

Appendix 3.13-C. No field or onsite visits were made for this Program EIR/EIS. GIS files of proposed rail improvement alignments were digitally overlaid on top of the datasets of biological resources and wetlands to identify locations where the study areas around potential alignments for proposed rail improvements might include portions of sensitive biological areas.

The areas of overlap—wherever the study area included a sensitive vegetation community or habitat—were considered to constitute areas of potential impacts from the proposed alignment. The number of reported occurrences of a particular biological resource within the study area, the linear contact of the study area with the biological resource, and acreage of the resource within the study area were counted and compiled. Vegetation communities considered to be non-sensitive were not included in this level of environmental analysis but would be included in project-level analysis.

The study area was defined as a broad corridor along alternative alignments to characterize the types and extent of biological resources and wetlands present. As described later in this chapter, the initial study area was later reduced in areal extent for impact analysis. After discussions with regulatory agencies, the impact corridors were narrowed to more realistically represent the potential for impacts while still encompassing both direct and indirect construction-related and operational impacts.

There are inevitable inaccuracies and gaps in the statewide and federal datasets and vegetation data layers due to differences in collection methods, dates when the data was first collected, changes in habitat conditions, and a myriad of other factors. For the scale of analysis for this Program EIR/EIS, these available data sources are considered appropriate to identify key differences between potential alignment options. Given the datasets, the lack of identification of an impact does not necessarily mean that this portion of the proposed alternative would not result in potential impacts on biological resources, only that location-specific data would be required to make a more precise determination. Likewise, the identification of a potential impact on a specific resource is intended to be conservative and in many instances may be an overstatement because neither habitat that is sensitive nor species of concern may be found in or near the footprint of the corridor or actual alignment. This may be the case, for example, for improvements proposed within the existing, disturbed LOSSAN rail corridor. Verification of potential impacts would require future location-specific study and evaluation to determine the level and extent of potential impact. This level of analysis would be part of subsequent project-level environmental review.

C. SIGNIFICANCE CRITERIA FOR BIOLOGICAL RESOURCES

The significance criteria for identifying potential impacts on biological resources from proposed projects/actions are based on federal and state guidelines and general indicators of significance, including guidelines or criteria in NEPA, CEQA, CWA, the CESA, FESA, and the California Fish and Game Code. Project-specific criteria would be applied at the project level of environmental analysis when permits are being sought, if a decision is made to proceed with proposed rail improvements following this program-level analysis.

Based on the presence or absence of sensitive resources, an alternative may have a significant impact on biological resources if its implementation would result in any of the following.

- Potential modification or destruction of habitat, movement/migration corridors, or breeding areas of endangered, threatened, rare, or other species as described above.
- Potential loss of a substantial number of any species that could affect the abundance or diversity of that species beyond the level of normal variability.
- Potential impacts on or measurable degradation of protected habitats; sensitive natural vegetation communities; wetlands; or other habitat areas' plans, policies, or regulations.
- Potential conflict with the provisions of an adopted habitat conservation plan (HCP), natural community conservation plan[1] (NCCP), or other approved local, regional, or state habitat conservation plan.
- Potential conflict with local ordinances protecting biological resources, such as a tree or creek preservation policy or ordinance.

3.13.2 Affected Environment

A. STUDY AREA DEFINED

The study area used to characterize the biological resources and wetlands within the project region is defined by the following limits.

- 1,000 ft (305 m) on either side of alignment centerlines and around stations in urbanized areas.
- 0.50 mi (0.81 km) on either side of alignment centerlines and around stations in sensitive areas.

In the LOSSAN project area, all station sites (existing and proposed) are located within urbanized areas. Other than the undeveloped area of Camp Pendleton and several other small open areas, the majority of the study area is designated by census data as urbanized. Therefore, most of the area was inventoried using the 1,000-ft (305-m) on either side of centerline (2,000-ft [610-m] corridor). Because of the sensitive nature of six lagoons, the areas surrounding lagoons were inventoried using 0.50-mi (0.81-km) either side of centerline, or a 1.0-mi (1.6-km) wide corridor. All other undeveloped areas within this project area are considered sensitive and therefore also were inventoried using the 1.0-mi (1.6-km) corridor.

1 The NCCP program of CDFG is an effort by the State of California and many private and public partners that takes a broad-based ecosystem approach to planning for the protection and perpetuation of biological diversity. An NCCP identifies and provides for the regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. CDFG and USFWS provide the necessary support, direction, and guidance to NCCP participants in these functions.

B. GENERAL DISCUSSION OF BIOLOGICAL RESOURCES AND WETLANDS

Following is a brief description of the resource topics reviewed in this section. A more detailed description of these resources and the sources of information used to obtain the description are provided in Appendix 3.13-A. In addition, this section discusses habitat conservation plans (HCPs), critical habitat[2] areas, and other conservation plans or areas that could potentially be affected by one or more of the alignment options discussed in this document.

Sensitive Vegetation Communities

Sensitive vegetation communities are natural communities (assemblages of species, both plant and wildlife, forming communities) and wildlife habitats that are unique, of relatively limited distribution in the region, or of particularly high wildlife value. These resources have been defined by federal, state, and local government conservation programs.

Sensitive Plant Species

Sensitive plant species include species that have been afforded special status and/or recognition by federal and state resource agencies, as well as private conservation organizations, because of documented or perceived decline or limitation of population size or geographical extent.

Sensitive Wildlife Species

Sensitive wildlife species include species that have been afforded special status and/or recognition by federal and state resource agencies, as well as private conservation organizations, because of documented or perceived decline or limitation of population size or geographical extent. Special-status species include wildlife, fish, or animals that are legally protected, or that are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status species include species listed as state and/or federal threatened or endangered species under FESA or CESA, those considered as candidates for listing, and species identified by USFWS and/or CDFG as California species of special concern.

Wildlife Movement/Migration Corridors

Wildlife movement/migration corridors link together areas of wildlife habitat that are otherwise separated by rugged terrain, changes in vegetation, or human disturbance. The fragmentation of open space areas by urbanization tends to create isolated islands of wildlife habitat.

Water Resources

Lakes, lagoons, rivers, streams, and other water bodies are protected by federal and/or state law. Special aquatic sites, which include wetlands, are considered an important subset of these waters. Wetlands and certain other waters would be delineated as part of a subsequent environmental review process.

2 Critical habitat refers to areas shown on maps developed by USFWS that provide habitat for threatened and endangered species.

C. BIOLOGICAL RESOURCES AND WETLANDS IN THE STUDY AREA

Following is a discussion of resources within the study area for the topics described above. The mapped occurrences of these resources within the study area are summarized at the end of this section.

Regional Summary

The LOSSAN region includes the western portion of the Los Angeles basin and the coastal areas of southern California between Los Angeles and San Diego, generally following the existing LOSSAN rail corridor. The entire study area lies within the South Coast Bioregion, an area of contrasting landscapes ranging from coastal mountains, canyons, streams and river valleys, rolling hills, and beaches to densely populated cities. The region more specifically lies within the Peninsular Range Physiographic Province. This area is characterized by a Mediterranean climate with winter rainfalls and summer droughts. Average annual rainfall ranges from 9 in (23 cm) in the San Diego region to 15 in (38 cm) in the Los Angeles basin.

In San Diego County, the study area is further characterized by the presence of large coastal wetlands, including six lagoons located in the northern part of the county. These lagoons and the associated open space around them provide vital habitat for resident and migratory birds and other wildlife. Sensitive plant and animal species are found here in substantial numbers despite increasing urbanization, hydrological changes in the watershed, and limited tidal action.

Sensitive Vegetation Communities

Upland Vegetation: Diegan coastal sage scrub is the most commonly found sage scrub community in coastal southern California, ranging from Los Angeles to Baja. This coastal sage scrub community is dominated by low soft-leaved, drought-deciduous shrubs and is typically found on dry sites and steep slopes. Diegan coastal sage scrub is considered sensitive and provides habitat for many endangered and threatened species. Due to spreading urbanization, this vegetation community has suffered severe reductions. For the purposes of this program-level of analysis, Diegan coastal sage scrub is considered the dominant sensitive vegetation in the study area. The distribution of this vegetation type in the study area is shown on Figure 3.13-1.

Other sensitive upland vegetation communities may include southern maritime chaparral, southern riparian scrub, southern riparian forest, southern cottonwood willow riparian forest, Torrey pine forest, southern dune scrub, southern foredunes, and San Diego mesa hardpan vernal pool.

Wetland Vegetation: Lagoons and other wetlands are also considered to encompass sensitive vegetation. Sensitive vegetation communities include southern coastal salt marsh, and coastal brackish marsh.

Sensitive Plant Species

The mosaic of vegetation communities that make up Diegan coastal sage scrub and the lagoon/wetlands supports a variety of sensitive plant species. Eight federally and state-listed species and 30 California Native Plant Society (CNPS) List 1B plants[3] have the potential to occur in the study area. These species are listed in Table 3.13-1.

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[3] List 1B plants have been determined by the CNPS to be rare, threatened or endangered in California or elsewhere.

Source : USDA Forest Service, 1997

U.S. Department of Transportation
Federal Railroad Administration

Caltrans

FIGURE 3.13-1

Distribution of Diegan Coastal Sage Scrub

LOSSAN Rail Corridor Improvements

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Table 3.13-1.
Sensitive Plant Species Potentially Occurring in Study Area

Common Name	Scientific Name	Fed List	Cal List	CNPS
DEL MAR MANZANITA	ARCTOSTAPHYLOS GLANDULOSA SSP CRASSIFOLIA	E		1B
COASTAL DUNES MILK-VETCH	ASTRAGALUS TENER VAR TITI	E	E	1B
COULTER'S SALTBUSH	ATRIPLEX COULTERI			1B
SOUTH COAST SALTSCALE	ATRIPLEX PACIFICA			1B
DAVIDSON'S SALTSCALE	ATRIPLEX SERENANA VAR DAVIDSONII			1B
THREAD-LEAVED BRODIAEA	BRODIAEA FILIFOLIA	T	E	1B
LAKESIDE CEANOTHUS	CEANOTHUS CYANEUS			1B
SOUTHERN TARPLANT	CENTROMADIA PARRYI SSP AUSTRALIS			1B
SMOOTH TARPLANT	CENTROMADIA PUNGENS SSP LAEVIS			1B
ORCUTT'S PINCUSHION	CHAENACTIS GLABRIUSCULA VAR ORCUTTIANA			1B
ORCUTT'S SPINEFLOWER	CHORIZANTHE ORCUTTIANA	E	E	1B
SAN FERNANDO VALLEY SPINEFLOWER	CHORIZANTHE PARRYI VAR FERNANDINA		E	1B
SUMMER HOLLY	COMAROSTAPHYLIS DIVERSIFOLIA SSP DIVERSIFOLIA			1B
SALT MARSH BIRD'S-BEAK	CORDYLANTHUS MARITIMUS SSP MARITIMUS	E	E	1B
DEL MAR MESA SAND ASTER	CORETHROGYNE FILAGINIFOLIA VAR LINIFOLIA			1B
BLOCHMAN'S DUDLEYA	DUDLEYA BLOCHMANIAE SSP BLOCHMANIAE			1B
SHORT-LEAVED DUDLEYA	DUDLEYA BREVIFOLIA		E	1B
MANY-STEMMED DUDLEYA	DUDLEYA MULTICAULIS			1B
VARIEGATED DUDLEYA	DUDLEYA VARIEGATA			1B
SAN DIEGO BUTTON-CELERY	ERYNGIUM ARISTULATUM VAR PARISHII	E	E	1B
PENDLETON BUTTON-CELERY	ERYNGIUM PENDLETONENSIS			1B
DECUMBENT GOLDENBUSH	ISOCOMA MENZIESII VAR DECUMBENS			1B
COULTER'S GOLDFIELDS	LASTHENIA GLABRATA SSP COULTERI			1B
ROBINSON'S PEPPER-GRASS	LEPIDIUM VIRGINICUM VAR ROBINSONII			1B
NUTTALL'S LOTUS	LOTUS NUTTALLIANUS			1B
SAN DIEGO GOLDENSTAR	MUILLA CLEVELANDII			1B
PROSTRATE NAVARRETIA	NAVARRETIA PROSTRATA			1B
COAST WOOLLY-HEADS	NEMACAULIS DENUDATA VAR DENUDATA			1B
BRAND'S PHACELIA	PHACELIA STELLARIS			1B
TORREY PINE	PINUS TORREYANA SSP TORREYANA			1B
NUTTALL'S SCRUB OAK	QUERCUS DUMOSA			1B
OIL NESTSTRAW	STYLOCLINE CITROLEUM			1B

Notes:
E = Endangered
T = Threatened
1B = California Native Plant Society (CNPS) List 1B plant species

Sensitive Wildlife Species

Sensitive wildlife species potentially present within the study area include invertebrates, fish, reptiles and amphibians, birds and mammals. Table 3.13-2 lists the wildlife species potentially present in the study area that are federally or state-listed as threatened or endangered, or state-listed as species of concern.

Table 3.13-2
Sensitive Wildlife Species Potentially Occurring in Study Area

Common Name	Scientific Name	Fed List	Cal List	CDFG
INVERTEBRATES				
SAN DIEGO FAIRY SHRIMP	BRANCHINECTA SANDIEGONENSIS	E		
FISH				
TIDEWATER GOBY	EUCYCLOGOBIUS NEWBERRYI	E		SC
ARROYO CHUB	GILA ORCUTTI			SC
SOUTHERN STEELHEAD TROUT	ONCORHYNCHUS MYKISS IRIDEUS	E		SC
REPTILES-AMPHIBIANS				
ARROYO TOAD	BUFO CALIFORNICUS	E		SC
ORANGE-THROATED WHIPTAIL	CNEMIDOPHORUS HYPERYTHRUS			SC
COASTAL WESTERN WHIPTAIL	CNEMIDOPHORUS TIGRIS MULTISCUTATUS			
CORONADO SKINK	EUMECES SKILTONIANUS INTERPARIETALIS			SC
SAN DIEGO HORNED LIZARD	PHRYNOSOMA CORONATUM BLAINVILLEI			SC
WESTERN SPADEFOOT	SCAPHIOPUS HAMMONDII			SC
BIRDS				
SOUTHERN CALIFORNIA RUFOUS-CROWNED SPARROW	AIMOPHILA RUFICEPS CANESCENS			SC
BURROWING OWL	ATHENE CUNICULARIA			SC
COASTAL CACTUS WREN	CAMPYLORHYNCHUS BRUNNEICAPILLUS COUESI			SC
WESTERN SNOWY PLOVER	CHARADRIUS ALEXANDRINUS NIVOSUS	T		SC
WHITE-TAILED KITE	ELANUS LEUCURUS			SC
CALIFORNIA BLACK RAIL	LATERALLUS JAMAICENSIS COTURNICULUS		T	
BELDING'S SAVANNAH SPARROW	PASSERCULUS SANDWICHENSIS BELDINGI		E	

Table 3.13-2
Sensitive Wildlife Species Potentially Occurring in Study Area (continued)

Common Name	Scientific Name	Fed List	Cal List	CDFG
BIRDS (continued)				
COASTAL CALIFORNIA GNATCATCHER	POLIOPTILA CALIFORNICA	T		SC
LIGHT-FOOTED CLAPPER RAIL	RALLUS LONGIROSTRIS LEVIPES	E	E	
BANK SWALLOW	RIPARIA RIPARIA		T	
CALIFORNIA LEAST TERN	STERNA ANTILLARUM BROWNI	E	E	
LEAST BELL'S VIREO	VIREO BELLII PUSILLUS	E	E	
MAMMALS				
NORTHWESTERN SAN DIEGO POCKET MOUSE	CHAETODIPUS FALLAX FALLAX			SC
SAN DIEGO DESERT WOODRAT	NEOTOMA LEPIDA INTERMEDIA			SC
PACIFIC POCKET MOUSE	PEROGNATHUS LONGIMEMBRIS PACIFICUS	E		SC

Notes:
E = Endangered
T = Threatened
SC = Species of Concern

Within the study area, all sensitive vegetation communities and lagoons are assumed to provide wildlife habitat. Designated critical habitat, as defined by the USFWS, may occur within the study area for coastal California gnatcatcher, least Bell's vireo, tidewater goby, and San Diego fairy shrimp.

Wildlife Movement/Migration Corridors

Only large open areas, lagoons and surrounding park or reserve areas, and riparian areas in undeveloped areas are considered potential wildlife movement corridors in the LOSSAN region. These include San Juan Creek, Camp Pendleton Marine Corps Base (includes San Mateo Creek, San Onofre Creek, and Santa Margarita River), San Luis Rey River, Buena Vista Lagoon, Aqua Hedionda Lagoon, Batiquitos Lagoon, San Elijo Lagoon, San Dieguito River and Lagoon, Los Peñasquitos Lagoon, Peñasquitos Creek and Canyon, Sorrento Valley, Rose Canyon, and San Clemente Canyon

Jurisdictional Waters

Non-Wetland Waters: The U.S. Army Corps of Engineers (USACE) has the jurisdictional authority over protection of Waters of the U.S., including non-wetland waters, under the provisions of the federal Clean Water Act. The California Department of Fish and Game (CDFG) also has authority to protect fish and wildlife in non-wetland waters. The streams and rivers in the study area are a mix of natural and channelized water bodies. These are considered "non-wetland waters" (Table 3.13-3) although the natural and some of the channelized streams and rivers do support wetland or riparian habitat.

Table 3.13-3
Rivers, Creeks and Bays in the Study Area

Los Angeles River	Santiago Creek	San Luis Rey River
Rio Hondo Channel	San Diego Creek	Loma Alta Creek
San Gabriel River	Peters Canyon Wash	San Dieguito River
Coyote Creek (multiple branches)	Oso Creek	Soledad Creek
La Mirada Creek	Trabuco Creek	Los Penasquitos Creek
Brea Creek	San Juan Creek	Mission Bay
Fullerton Creek	San Mateo Creek	Tecolote Creek
Carbon Creek	San Onofre Creek	San Diego River
Santa Ana River	Santa Margarita River	San Diego Bay

Wetlands: To classify an area as wetlands per the USACE, three jurisdictional criteria must be met: presence of wetland hydrology, predominance of hydrophytic plants, and presence of hydric soils. The CDFG currently utilizes a definition that requires that only one of these criteria be met in order to classify an area as wetlands.

Wetlands found in the "coastal zone" are also regulated under the California Coastal Act (CCA) and the federal Coastal Zone Management Act (CZMA), and are within jurisdiction of the California Coastal Commission. Under the CCA, wetlands are defined as land within the coastal zone that may be covered periodically or permanently with shallow water, and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, and fens.

The estuarine lagoons of northern San Diego County are within the coastal zone. They are a unique biological resource and are the focus of many resource agencies and other entities interested in the quality of these areas. The six lagoons in the study area are mapped on Figure 3.13-2, and include the Buena Vista, Agua Hedionda, Batiquitos, San Elijo, San Dieguito and Los Peñasquitos lagoons. Descriptions of these lagoons are provided in Appendix 3.13-D. Where restoration plans have been developed for the lagoons, these were reviewed and the primary goals of those plans are also summarized in the appendix.

Vernal pools, a potential component of coastal sage scrub or chaparral landscapes, are also considered another type of wetlands under California Wildlife Protection Act (Fish & Game Code §2785), and are regulated by the Regional Water Quality Control Board. Vernal pools are seasonally ponded areas that support a variety of specialized plant and animals, including federally and state-listed species. Vernal pools are likely to exist within the study area, particularly on the Camp Pendleton Marine Corps Base. The confirmation of the presence of vernal pools would be addressed in detail in project-level environmental analyses.

Source : Source : USFW Service, National Wetlands Inventory, Landiscor, 2002

U.S. Department of Transportation Federal Railroad Administration

Caltrans

FIGURE 3.13-2

North San Diego County Lagoons

LOSSAN Rail Corridor Improvements

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Conservation Plans and Habitat Reserves

Within the study area are several elements of regional Natural Community Conservation Plans (NCCP) which include various City Subarea Plans under the Multiple Habitat Conservation Program (MHCP). They include:

- City of San Diego Subregional Multiple Species Conservation Program (MSCP) (Subarea Plan)
- City of Encinitas Habitat Conservation Plan (HCP) (Subarea Plan)
- City of Carlsbad Habitat Management Plan (HMP) for Natural Communities (Subarea Plan)
- City of Oceanside HCP/NCCP (Subarea Plan)
- USMC Base Camp Pendleton Integrated Natural Resources Management Plan (Subregional)
- County of Orange Central and Coastal Subregional NCCP and HCP

There are also several reserve areas identified in the study area. The Batiquitos Lagoon at the southern edge of Carlsbad was made a CDFG-designated State Ecological Reserve in 1983. The San Elijo Lagoon is a CDFG-designated State Ecological Reserve. A portion of the San Dieguito Lagoon is also a CDFG-designated State Ecological Reserve, as is the recently designated Los Peñasquitos Lagoon State Preserve.

There are no known designated mitigation/conservation banks within the study area. Although there is a potential that the USFWS may designate critical habitat for some plants and animals as described in the sensitive species discussion above, there are no other known conservation easements, plans, or designated reserves in the study area.

Summary of Sensitive Resources in the Study Area

Table 3.13-4 summarizes the biological resources inventoried from existing databases (see Section 3.13.1.B, *Method of Evaluation of Impacts*) within the study area.

Table 3.13-4
Biological Resources and Wetlands in the Study Area

Rail Improvements Alignment Options	Sensitive Vegetation (Diegan Coastal Sage Scrub)[1] acres (hectares)	Wildlife Movement Corridors Yes or No	Number of Special-Status Species	NWI Wetlands acres (hectares)	Non-Wetland Jurisdictional Waters linear feet (meters)	Marine / Anadromous Fish Resources Yes or No
Union Station to Fullerton Station – 4th Main Track	0	NO	3	0	16,510 (5,032)	No
Fullerton Station To Irvine Station – Double Tracking						
AT-GRADE between Orange and Santa Ana	0	NO	3	0	2,193 (668)	No
TRENCH between Orange and Santa Ana	0	NO	3	0	2,193 (668)	No
Stations Fullerton	0	NO	1	0	0	No
Anaheim	0	NO	1	0	1,962 (598)	No
Santa Ana	0	NO	2	0	0	No
Irvine	0	NO	0	0	0	No
San Juan Capistrano Double Tracking						
TUNNEL along I-5 between HWY 73 and Avenida Aeropuerto	24 (10)	NO	3	34 (14)	21,215 (6,466)	No
AT-GRADE and OPEN TRENCH along east side of Trabuco Creek	24 (10)	NO	4*	15 (6)	30,408 (9,268)	Yes*
Stations San Juan Capistrano	0	NO	1	0	1,469 (448)	No
Dana Point/San Clemente Double Tracking						
Dana Point Curve Realignment; San Clemente – SHORT TUNNEL	0	YES	6	243 (98)	23,133 (7,051)	Yes
San Clemente – LONG TWO-SEGMENT TUNNEL; Double	0	YES	7	203 (82)	18,631 (5,679)	Yes
Stations San Clemente	0	YES	0	0	0	No
Camp Pendleton At-grade	‹1	YES	10	332 (134)	14,584 (4,445)	No

Table 3.13-4
Biological Resources and Wetlands in the Study Area (continued)

Rail Improvements Alignment Options	**Sensitive Vegetation (Diegan Coastal Sage Scrub)**[1] acres (hectares)	**Wildlife Movement Corridors** Yes or No	**Number of Special-Status Species**	**NWI Wetlands** acres (hectares)	**Non-Wetland Jurisdictional Waters** linear feet (meters)	**Marine / Anadromous Fish Resources** Yes or No
Oceanside/ Carlsbad Double Tracking						
Carlsbad – AT-GRADE; double tracking	0	YES	9	158 (64)	5,298 (1,615)	No
Carlsbad – TRENCH; double tracking	0	YES	9	158 (64)	5,298 (1,615)	No
Stations Oceanside	0	YES	5	4 (2)	550 (168)	No
Encinitas/Solana Beach Double Tracking						
Encinitas – AT-GRADE	0	YES	11	268 (108)	30836 (9,399)	No
Encinitas – SHORT-TRENCH	0	YES	11	268 (108)	30836 (9,399)	No
Stations Solana Beach	0	NO	4	2 (1)	600 (183)	No
Del Mar Double Tracking						
TUNNEL under Camino Del Mar	0	YES	12	337 (136)	37,088 (11,304)	No
TUNNEL along I-5	0	YES	17	178 (72)	32,920 (10,034)	No
I-5/805 Split To Hwy 52 Double Tracking						
Miramar Hill Tunnel	280 (113)	Possibly	10	19 (8)	9,690 (2,954)	No
I-5 Tunnel	0	Possibly	4	5 (2)	4,379 (1,335)	No
Stations UTC (Only applies to Miramar Hill Tunnel)	0	YES	1	8 (3)	0	No
Hwy 52 To Santa Fe Depot Curve Realignment and Double Tracking	0	YES	11	29 (12)	18,212 (5,551)	No
Stations Santa Fe Depot	0	NO	2	0	6,033 (1,839)	No

[1] Available GIS data does not allow quantification of lagoon vegetation, so no acreages are noted for potential sensitive vegetation communities associated with wetlands. These vegetation types are assumed to be included (where present) within the wetlands acreages shown in the table.

* Recent fish surveys in Trabuco Creek may have detected Steelhead according to USFWS (Jan.7, 2004); though unconfirmed, table data assumes Steelhead is present.

All numbers are rounded.

3.13.3 Environmental Consequences

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The biological resources and wetlands described above in the affected environment section (Section 3.13.2) characterize the existing conditions in the LOSSAN region potentially affected by the alternatives, drawing primarily from existing available data. Because this is a program-level analysis, data are representative rather than complete, and are for comparison purposes. Though some changes may occur between the existing conditions and the year 2020 due to natural changes in resources as well as urbanization and transportation projects that would be implemented by 2020 under the No Project Alternative, attempting to estimate the extent of these changes would be speculative at this time. Further, it is assumed that each of the projects associated with the No Project Alternative would incorporate and implement the appropriate mitigation and monitoring measures to minimize or avoid significant impacts on sensitive biological and wetland resources. It is also realistic to project that urbanization in some of the regions resulting from population growth over the next 17 years (to 2020) would change the conditions reported in this document, and that continued efforts by local communities and nonprofit organizations (e.g., The Nature Conservancy) would continue to expand protected areas (habitat conservation planning areas). Because estimating the extent of change prior to 2020 would be speculative, no substantial change to the existing conditions is assumed for purposes of this program-level evaluation and comparison of alternatives.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

Biological resources and wetlands were identified within a broad study area, as described above in Section 3.13.2, *Affected Environment*. However, after discussions between the lead agencies and resource agencies, it was determined that a narrower impact analysis zone would provide a more realistic indication of the potential for impacts to biological resources, and a more meaningful comparison of the alternatives. The construction disturbance zone, including the area within which indirect impacts could occur, and the permanent footprint of the proposed rail improvements would be much narrower than the inventoried study area (2,000 ft [610m] to 1.0 mi [1.6 km] in width). The maximum footprint of the proposed improvements would be less than 50 ft (15 m). Based on this footprint, it was determined that construction-related impacts and indirect impacts (such as noise) could occur within 100 ft (30 m) either side of the centerline.

Therefore, two impact analysis zones were delineated that provide for a reasonable assessment of the potential for temporary, permanent, direct and indirect impacts to biological resources. These impact analysis zones are defined as follows.

- **Impact Zone A**: 100 feet (30 m) on either side of the centerline of alignments and stations (200 feet; 61 m) to encompass potential temporary and indirect (temporary or permanent) impacts.
- **Impact Zone B**: 25 feet (7.6 m) on either side of the centerline of alignments and stations (50 feet; 15 m) to encompass potential direct, permanent impacts.

Temporary impacts would be those related to construction activities including, but not limited to, construction access, material storage, excavation spoils handling areas, staging areas. Potential impacts may include disturbance to or removal of habitat or sensitive plant species or vegetation communities, and wildlife displacement and disruption. In lagoon areas and bridge work across rivers and streams, construction may involve extensive in-water work, resulting in turbidity and sedimentation impacts, and disturbance or removal of underwater habitat features such as large rocks, boulders, or existing earthen fill. Temporary indirect impacts would include those resulting from construction-related noise (including construction equipment, haul trucks, and tunnel portal excavation activities), lighting during nighttime work, and other disruptions to or physical separation of habitat areas.

Potential permanent impacts may also be direct or indirect. Direct impacts would include wildlife mortality, and permanent displacement and removal of vegetation and habitat within the footprint of the physical improvements. Indirect operational impacts may include noise from trains (including horns), and increased shadow effects from elevated infrastructure over plant and wildlife habitat areas.

The potential for disturbance to high quality habitat areas would be reduced in areas where improvements would be constructed within the highly disturbed LOSSAN rail right-of-way, and would be avoided in areas of deep tunnels except at tunnel portals. Trenching options would disturb more surface and near-surface resources than at-grade options because of the need to taper trench walls and utilize lay-down areas for excavated spoils.

As part of its conceptual design, the project proponents have committed to maintaining either the same footprint or a smaller footprint where improvements would cross water bodies. The footprint of existing bridges across bodies of water, including the six lagoons in San Diego County, would not be increased under the proposed Rail Improvement Alternative because new bridges would replace older bridges, and the new bridges would use materials and designs to minimize the number of piles/columns in the water and would retain the same or smaller footprint of the existing span.

This section provides a general comparison of resources potentially impacted by the various alignment options evaluated for the Rail Improvements Alternative. Table 3.13-5 summarizes the biological resources and wetlands within the impact analysis zone delineated to encompass both temporary (construction) and indirect impacts. Table 3.13-6 summarizes the resources potentially affected by the permanent footprint of the proposed improvements. Potential impacts and differences between alignment options are described below. Appendix 3.13-E provides lists of specific special-status plant and wildlife species present within the study area of each of the alignment options.

As stated earlier, all comparisons are based on information currently available from existing databases. Field surveys, which would be performed during a subsequent environmental review, would provide more detailed information and could indicate an increase or a decrease in the potential impacts on biological resources from a proposed alignment option, particularly along routes that have not previously been the focus of field surveys or mapping by any of the regulatory agencies such as CDFG or USFWS.

Table 3.13.5
Biological Resources and Wetlands in the 200-Foot (61 m) Impact Analysis Zone (Impact Zone A)

Rail Improvements Alignment Options	**Sensitive Vegetation (Diegan Coastal Sage Scrub)**[1] acres (hectares)	**Wildlife Movement Corridors** Yes or No	**Number of Special-Status Species**	**NWI Wetlands** acres (hectares)	**Non-Wetland Jurisdictional Waters** linear feet (meters)	**Marine / Anadromous Fish Resources** Yes or No
Union Station to Fullerton Station – 4th Main Track	0	NO	3	0	1,568 (478)	No
Fullerton Station To Irvine Station – Double Tracking						
AT-GRADE between Orange and Santa Ana	0	NO	3	0	201 (61)	No
TRENCH between Orange and Santa Ana	0	NO	3	0	201 (61)	No
Stations Fullerton	0	NO	1	0	0	No
Anaheim	0	NO	1	0	0	No
Santa Ana	0	NO	2	0	0	No
Irvine	0	NO	0	0	0	No
San Juan Capistrano Double Tracking						
TUNNEL along I-5 between HWY 73 and Avenida Aeropuerto	0	NO	3	3 (1)	3,078 (938)	No
AT-GRADE and OPEN TRENCH along east side of Trabuco Creek	0	NO	4*	‹1 (‹1)	3,525 (1,074)	Yes*
Stations San Juan Capistrano	0	NO	1	0	0	No
Dana Point/San Clemente Double Tracking						
Dana Point Curve Realignment; San Clemente – SHORT TUNNEL	0	YES	6	2 (‹1)	1,934 (589)	Yes
San Clemente – LONG TWO-SEGMENT TUNNEL; Double	0	YES	7	2 (‹1)	499 (152)	Yes
Stations San Clemente	0	YES	0	0	0	No
Camp Pendleton At-grade	0	YES	10	10 (4)	218 (66)	No

Table 3.13.5
Biological Resources and Wetlands in the 200-Foot (61 m) Impact Analysis Zone (Impact Zone A) (continued)

Rail Improvements Alignment Options	**Sensitive Vegetation (Diegan Coastal Sage Scrub)**[1] acres (hectares)	**Wildlife Movement Corridors** Yes or No	**Number of Special-Status Species**	**NWI Wetlands** acres (hectares)	**Non-Wetland Jurisdictional Waters** linear feet (meters)	**Marine / Anadromous Fish Resources** Yes or No
Oceanside/ Carlsbad Double Tracking						
Carlsbad–AT-GRADE; double tracking	0	YES	9	8 (3)	688 (210)	No
Carlsbad–TRENCH; double tracking	0	YES	9	8 (3)	688 (210)	No
Stations Oceanside	0	YES	5	0	0	No
Encinitas/Solana Beach Double Tracking						
Encinitas – AT-GRADE	0	YES	11	14 (6)	2,136 (651)	No
Encinitas – SHORT-TRENCH	0	YES	11	14 (6)	2,136 (651)	No
Stations Solana Beach	0	NO	2	0	0	No
Del Mar Double Tracking						
TUNNEL under Camino Del Mar	0	YES	12	30 (12)	2,740 (835)	No
TUNNEL along I-5	0	YES	17	2 (‹1)	3,410 (1,039)	No
I-5/805 Split To Hwy 52 Double Tracking						
Miramar Hill Tunnel	0	Possibly	10	3 (1)	1,032 (315)	No
I-5 Tunnel	28 (11)	Possibly	4	0	607 (185)	No
Stations UTC (Only applies to Miramar Hill Tunnel)	0	YES	1	0	0	No
Hwy 52 To Santa Fe Depot Curve Realignment and Double Tracking	0	YES	11	5 (2)	632 (193)	No
Stations Santa Fe Depot	0	NO	2	0	197 (60)	No

[1] Available GIS data does not allow quantification of lagoon vegetation, so no acreages are noted for potential sensitive vegetation communities associated with wetlands. These vegetation types are assumed to be included (where present) within the wetlands acreages shown in the table.
* Recent fish surveys in Trabuco Creek may have detected Steelhead according to USFWS (Jan.7, 2004); though unconfirmed, table data assumes Steelhead is present.
All numbers are rounded.

Table 3.13-6
Biological Resources and Wetlands in the 50-Foot (15 m) Impact Analysis Zone (Impact Zone B)

Rail Improvements Alignment Options	**Sensitive Vegetation (Diegan Coastal Sage Scrub)**[1] acres (hectares)	**Wildlife Movement Corridors** Yes or No	**Number of Special-Status Species**	**NWI Wetlands** acres (hectares)	**Non-Wetland Jurisdictional Waters** linear feet (meters)	**Marine / Anadromous Fish Resources** Yes or No
Union Station to Fullerton Station – 4th Main Track	0	NO	3	0	382 (116)	No
Fullerton Station To Irvine Station – Double Tracking						
AT-GRADE between Orange and Santa Ana	0	NO	3	0	50 (15)	No
TRENCH between Orange and Santa Ana	0	NO	3	0	50 (15)	No
Stations Fullerton	0	NO	1	0	0	No
Anaheim	0	NO	1	0	0	No
Santa Ana	0	NO	0	0	0	No
Irvine	0	NO	0	0	0	No
San Juan Capistrano Double Tracking						
TUNNEL along I-5 between HWY 73 and Avenida Aeropuerto	0	NO	3	‹1 (‹1)	1,015 (309)	No
AT-GRADE and OPEN TRENCH along east side of Trabuco Creek	0	NO	4*	‹1 (‹1)	1,168 (356)	Yes*
Stations San Juan Capistrano	0	NO	0	0	0	No
Dana Point/San Clemente Double Tracking						
Dana Point Curve Realignment; San Clemente – SHORT TUNNEL	0	YES	6	‹1 (‹1)	473 (144)	Yes
San Clemente – LONG TWO-SEGMENT TUNNEL; Double	0	YES	7	‹1 (‹1)	118 (36)	Yes
Stations San Clemente	0	YES	0	0	0	No
Camp Pendleton At-grade	0	YES	10	2 (‹1)	54 (16)	No

Table 3.13-6
Biological Resources and Wetlands in the 50-Foot (15 m) Impact Analysis Zone (Impact Zone B) (continued)

Rail Improvements Alignment Options	**Sensitive Vegetation (Diegan Coastal Sage Scrub)**[1] acres (hectares)	**Wildlife Movement Corridors** Yes or No	**Number of Special-Status Species**	**NWI Wetlands** acres (hectares)	**Non-Wetland Jurisdictional Waters** linear feet (meters)	**Marine / Anadromous Fish Resources** Yes or No
Oceanside/ Carlsbad Double Tracking						
Carlsbad – AT-GRADE; double tracking	0	YES	9	2 (‹1)	172 (52)	No
Carlsbad–TRENCH; double tracking	0	YES	9	2 (‹1)	172 (52)	No
Stations Oceanside	0	YES	5	0	0	No
Encinitas/Solana Beach Double Tracking						
Encinitas – AT-GRADE	0	YES	11	4 (2)	1,403 (428)	No
Encinitas – SHORT-TRENCH	0	YES	11	4 (2)	1,403 (428)	No
Stations Solana Beach	0	NO	2	0	0	No
Del Mar Double Tracking						
TUNNEL under Camino Del Mar	0	YES	12	8 (3)	652 (199)	No
TUNNEL along I-5	0	YES	17	‹1 (‹1)	1,069 (326)	No
I-5/805 Split To Hwy 52 Double Tracking						
Miramar Hill Tunnel	0	Possibly	10	‹1 (‹1)	235 (72)	No
I-5 Tunnel	7 (3)	Possibly	4	0	167 (51)	No
Stations UTC (Only applies to Miramar Hill Tunnel)	0	YES	1	0	0	No
Hwy 52 To Santa Fe Depot Curve Realignment and Double Tracking	0	YES	11	1 (‹1)	1588 (4)	No
Stations Santa Fe Depot	0	NO	2	0	52 (16)	No

1 Available GIS data does not allow quantification of lagoon vegetation, so no acreages are noted for potential sensitive vegetation communities associated with wetlands. These vegetation types are assumed to be included (where present) within the wetlands acreages shown in the table.
* Recent fish surveys in Trabuco Creek may have detected Steelhead according to USFWS (Jan.7, 2004); though unconfirmed, table data assumes Steelhead is present.
All numbers are rounded.

The number and extent of biological resources potentially affected by the Rail Improvements Alternative would vary with alignment options. A range of potential impacts was developed that represents the options with the fewest to the greatest potential impacts within the region. Based on existing data and information, the amount of sensitive vegetation present in Impact Zone A of the Rail Improvements Alternative ranges from none to approximately 28 acres (11 ha). The amount of sensitive vegetation present in Impact Zone B ranges from none to 7 acres (3 ha). Within Impact Zone A, the amount of non-wetland waters ranges from approximately 12,564 to 15,541 linear ft (3,830 to 4,737 m) of non-wetland waters, and between 41 and 75 ac (17 to 30 ha) of wetlands. Within Impact Zone B, non-wetland waters range from 4,223 to 5,216 linear ft (1,287 to 1,590 m) of non-wetland waters, and between 20 and 27 ac (8 to 11 ha) of wetlands. Between 36 and 46 different special-status plant and wildlife species were identified as potentially occurring within both the A and B impact zones and could be impacted by the Rail Improvements Alternative. (This range represents the number of species, not the number of occurrences of any given species in the study area. One species may occur within the impact zone of numerous rail segments. See Appendix 3.13-E for the species in each segment.)

Regardless of alignment options chosen, at least three-quarters of the proposed improvements would be constructed either within the existing LOSSAN rail right-of-way or within deep tunnels. These construction methods would substantially reduce the potential for impact to biological resources.

Potential impacts and key differences between alignment options are described below for each rail segment.

Union Station to Irvine Station

Between Union Station and Fullerton Station, the proposed addition of a fourth main track would be constructed at-grade within the existing rail corridor except between the Rio Hondo and San Gabriel rivers where up to 1 ac (0.40 ha) of industrial and commercial property outside the rail right-of-way may be disturbed. From Fullerton Station to the Irvine Station, the proposed alignment options include double tracking at grade or trenching within the existing rail right-of-way.

In this rail segment, no sensitive vegetation communities are present but five special-status species are recorded. Due to the dense urbanization of this area and the lack of sensitive vegetation communities, it is unlikely that these species exist in or adjacent to the highly disturbed rail corridor.

Waters potentially impacted include the Brea Creek, Rio Hondo, Coyote Creek, La Mirada Creek, and San Gabriel River. Potential impacts would be minimal because proposed improvements would be in the existing rail corridor through a dense urban area, and most the waters in this area are channelized.

San Juan Capistrano

The 1-5 tunnel option through San Juan Capistrano would run underneath Trabuco Creek and San Juan Creek. The other option is a covered and open trench and at-grade alignment along the east side of Trabuco Creek. This option would leave the existing LOSSAN corridor alignment just south of Trabuco Creek, and would include a new rail bridge over San Juan Creek and a replacement of the existing bridge over Trabuco Creek. A new below-grade station is proposed as part of this option.

No Diegan coastal sage scrub is recorded in this segment. However, some southern cottonwood willow riparian forest is present in the potential impact area. Three special-status species are recorded in the study area for both alignment options. In addition to the species recorded in the CNDDB, the USFWS reports that recent fish surveys in Trabuco Creek may have detected Steelhead, a federally listed endangered species (USFWS, pers. comm., January 7, 2004). If present, this species could be affected by trench construction along the eastern bank of Trabuco Creek. USFWS data indicate that designated critical habitat for one of these species, the Coastal California gnatcatcher, would potentially be affected by either option in this rail segment[1].

There are no known wildlife movement corridors in this rail segment, although some wildlife movement may occur down the San Juan Creek and other creek drainages to and from the coast. Because the area is highly urbanized it is likely that drainages in this area are used as core movement corridors.

There are more non-wetland waters within the study area for the trench/at-grade option than for the tunnel alignment. Waters potentially impacted by this alignment include Trabuco Creek and San Juan Creek. USFWS has voiced concerns about potentially substantial impacts to Trabuco Creek as a result of trenching directly adjacent to the eastern bank and potential flood impacts to the western bank (refer to Section 3.12, *Hydrology and Water Resources*).

The tunnel option would avoid most potential impacts except at portal areas, and would be superior to the trench option in minimizing the potential for impacts to biological resources. The trench option along Trabuco Creek has more potential for impacts on the creek and special-status species. While the trench and at-grade option could be routed to avoid direct impacts on the creek, the tunnel option would have less surface disturbance and would therefore affect fewer biological resources.

Dana Point/San Clemente

Two options for rail improvements were evaluated in this section: short tunnel, and one long tunnel divided into two segments. The short tunnel would include a curve realignment at Dana Point. The long two-segment tunnel option begins north of the Dana Point curve realignment project and would therefore make the curve realignment unnecessary. The two-segment tunnel would include a new station located between the tunnel segments.

CNNDB records some areas of southern cottonwood willow riparian forest, southern coastal salt marsh, and southern dune scrub in the study area for both alignment options. There are six special-status species recorded along the short-tunnel alignment, and seven along the longer tunnel. Potential impacts would be reduced due to tunneling, with the longer tunnel option affecting fewer of these resources.

USFWS data indicate that designated critical habitat for the Coastal California gnatcatcher and tidewater goby present in the study areas of both improvement options[1].

[1] USFWS designated critical habitat for a particular sensitive species may be present even if there is no known or recorded occurrence of the species or its habitat listed in the databases utilized for this project.

San Mateo Creek and San Onofre Creek may provide some narrow wildlife movement corridors crossed by both alignments. The long tunnel option would result in the fewest impacts to these resources due to the length of tunneling and by precluding the need for the at-grade curve realignment required for the short-tunnel option.

Both tunnel options would run under San Mateo Creek, but the short tunnel would transition up to grade just north of San Onofre Creek and require a bridge structure over the creek. The potential for both temporary and permanent impacts to San Onofre Creek would be greater with the short tunnel option. San Juan Creek runs parallel to the Dana Point curve realignment proposed as part of the short-tunnel option, although construction would be far enough from the creek that impacts would be unlikely.

The long tunnel would affect fewer biological resources because of its greater length and because the at-grade curve alignment would not be necessary with this option.

Camp Pendleton

Double tracking would occur within the existing LOSSAN rail right-of-way in this rail segment. Available data shows no Diegan coastal sage scrub in this segment, but scattered patches are likely to be present. Ten special-status species are recorded in this segment. USFWS data indicate that designated critical habitat for the Coastal California gnatcatcher, tidewater goby, and San Diego fairy shrimp[1] would potentially be affected in this segment. It is possible that some vernal pool habitat is also present in the study area. Because of the large open and undeveloped areas of Camp Pendleton, this area is considered a potential wildlife movement corridor, but the addition of a second track within the right-of-way would not change the existing condition for wildlife movement.

A rail bridge replacement project over the Santa Margarita River is part of the programmed improvements included in the No Project Alternative in this rail segment. The Rail Improvements Alternative would not have any additional impacts on this river.

Oceanside/Carlsbad

Rail alignment options evaluated in this section include an at-grade and a trenched double-tracking option within the existing LOSSAN rail right-of-way. The CNDDB records some areas of southern coastal salt marsh and other sensitive vegetation associated with lagoons in this study area, as well as 9 special-status species. USFWS data indicate that designated critical habitat for the tidewater goby and San Diego fairy shrimp[1] would potentially be impacted in this segment. Waters and wildlife habitat could be impacted at the San Luis Rey River, Buena Vista Lagoon and Ecological Reserve, Agua Hedionda Lagoon and surrounding open areas, and the Batiquitos Lagoon and Ecological Reserve, particularly during construction near or in the waterways and lagoons. Wildlife may utilize this reach of the San Luis Rey River as a movement corridor because the area is highly urbanized.

The potential for impacts on biological resources in most portions of this rail segment would be minimized because either the at-grade or trenched option would occur within the disturbed rail right-of-way through urbanized areas. In lagoon areas, no net increase in the footprint of existing rail bridges would occur, but temporary construction disturbance in and around the lagoons would potentially affect species and habitat associated with the lagoons. (These potentially substantial impacts are described in the introduction to this Environmental Consequences section.) There would not be a significant difference in potential impacts from the trench and at-grade options in this rail segment.

Encinitas/Solana Beach

The Rail Improvement Alternative in this section includes double tracking either at-grade or with a short-trench option within the same alignment in the existing LOSSAN rail right-of-way. The CNDDB records some areas of southern coastal salt marsh and southern maritime chaparral in this rail segment, as well as 11 special-status species. Wildlife habitat, and possibly wildlife movement corridors, would be temporarily be impacted at the San Elijo Lagoon and Ecological Reserve during construction in or around the lagoon.

Approximately 14 acres of wetlands are mapped within Impact Zone A of both alignment options, but construction within the existing rail corridor would minimize potential impacts. Jurisdictional waters potentially affected include the San Elijo Lagoon. There would be no net increase in the footprint of the rail infrastructure within the San Elijo Lagoon, but construction disturbance would potentially impact species and habitat in this area. (There may be the opportunity to replace the existing bridge with a new structure that would increase the tidal flow and remove the embankment from the lagoon; see Section 3.13.4, *Mitigation Strategies*).

There would not be a substantial difference in potential impacts from the trench and at-grade options in this rail section. Both options are along the existing LOSSAN corridor alignment in urbanized areas, and both would have temporary impacts on the lagoon and ecological reserve.

Del Mar

The Rail improvements Alternative through the Del Mar area includes two alignment options: a tunnel under Camino Del Mar, or a tunnel along I-5. These alignment options and the existing LOSSAN rail corridor are shown in Figure 13.3-3 to illustrate their location in relation to two lagoons.

No Diegan coastal sage scrub is mapped along either of the alignment options but CNDDB records some areas of southern coastal salt marsh. In addition, there are some areas of southern maritime chaparral mapped along the tunnel alignment.

The CNDDB records 12 special-status species along the Camino del Mar alignment, and 17 along the I-5 tunnel alignment. For either alignment option, wildlife habitat, and possible wildlife movement corridors, would be affected at the San Dieguito Lagoon and surrounding open areas, and Los Penãsquitos Lagoon and Preserve. These sensitive habitat areas would be subject to disturbance during construction, including indirect impacts from noise and lighting during possible nighttime construction work.

There are 30 ac (12 ha) of wetlands and nearly 2,740 linear ft (835 m) of non-wetland waters mapped within Impact Zone A for the Camino del Mar tunnel alignment. Some of this wetlands acreage includes the San Dieguito River/Lagoon and Los Penãsquitos Lagoon that may be impacted during construction. The I-5 alignment encompasses only 2 ac (less than 1 ha) but over 3,400 linear ft (1,036 m) of non-wetland waters.

Either alignment option in the Del Mar area would involve deep tunneling that would avoid disturbance to most biological resources, except at portal areas. The Camino del

Mar option would involve double-tracking across the Los Peñasquitos and San Dieguito lagoons on the existing rail bridges, which would be done without any net increase in the footprint of the rail infrastructure within the lagoons, and without substantive in-water work. Construction along the lagoon perimeters would have direct and indirect impacts on habitat and wildlife during construction. (There may be the opportunity to replace the existing bridge across Los Penasquitos with a causeway structure that would increase the tidal flow and remove the embankment from the lagoons. This would require extensive in-water work, causing higher impacts during construction, but would result in a long-term beneficial impact to the lagoon. The feasibility and potential benefits and impacts would be determined in project-level analyses.)

The I-5 tunnel would avoid crossing of the Los Peñasquitos Lagoon but the design concept would include a new, elevated structure along the south edge of San Dieguito Lagoon, which may result in potential new, temporary and permanent impacts on sensitive biological resources. The I-5 tunnel option would allow for the removal of the existing rail bridge structure in the future. Bridge removal would have temporary impacts on the lagoon from extensive in-water work to remove the existing structure.

Overall, the Camino del Mar tunnel would likely have fewer potential impacts on biological resources associated with the lagoons, because it would not involve extensive in-water work during construction across the existing lagoon bridges, and would not introduce new structures to the southern edge of San Dieguito Lagoon.

I-5/805 Split to Highway 52

The Rail Improvement Alternative in this section includes two tunnel alignments: one running through Miramar Hill and one running along and under Interstate 5. A new underground station is proposed at University Towne Centre (UTC) as part of the Miramar Hill tunnel alignment option.

There are 28 ac (11 ha) of mapped Diegan coastal sage scrub in the study area for the I-5 tunnel, while the Miramar Hill alignment contains no sensitive vegetation communities. The CNDDB records 10 special-status species within the study area of for the Miramar Hill and 4 special-status species for the I-5 option. Portals at the ends of either tunnel may affect the movement of wildlife along north facing slopes above Peñasquitos Creek and Sorrento Valley, and in the canyons south of UTC.

Potential impacts to wetlands and jurisdictional waters would be minimal because of the deep tunneling with either option, and would occur at the portal areas only. At the proposed UTC underground station, some construction impacts could occur on the surface; however, the area surrounding the UTC station is urbanized so impacts to wetlands and waters are unlikely.

The proposed deep tunneling to be utilized for either option in this segment would minimize potential impacts to biological resources and wetlands. The current level of data does not allow any significant differentiation between the potential impacts associated with these two tunnel options.

Source : HDR; IBI Group; Landiscor; 2002

FIGURE 3.13-3

Del Mar Area Lagoons and Alignment Options

LOSSAN Rail Corridor Improvements

Program Environmental Impact Report / Environmental Impact Statement

Caltrans

U.S. Department of Transportation
Federal Railroad Administration

Highway 52 to San Diego Santa Fe Depot

Proposed improvements in this rail segment include double tracking in the existing rail corridor, a curve realignment, and a trench between Sassafras Street and Cedar Street. Station improvements are proposed at Santa Fe Depot. The CNDDB records some areas of southern cottonwood willow riparian forest and southern riparian forest in the study area, as well as 1 special-status species. Wildlife movement corridors may be present in Rose Canyon and San Clemente Canyon adjacent to the existing LOSSAN rail corridor.

Approximately 5 ac (2 ha) of wetlands could be temporarily impacted by the proposed rail improvements in this segment. Non-wetland waters and associated wetlands within the study corridor and around the Santa Fe Depot include the San Diego River and Mission Bay. However, the Santa Fe Depot is surrounded by heavy urbanization making impacts to jurisdictional waters unlikely in this station area. The Mission Bay parallels the study area, but is not likely to be affected due to its distance from the existing rail corridor.

3.13.4 Mitigation Strategies

Potential strategies to mitigate impacts on biological resources would include field verification of sensitive resources and filling data gaps to support designs that would avoid impacts on special-status species and sensitive habitat areas. Consideration of participation in or contribution to existing or proposed conservation banks or natural management areas to mitigate potentially significant impacts that could not be avoided would also be part of the potential mitigation during future project level analysis. Avoidance of potential impacts may be achieved through project design changes to reduce the impact footprint or relocation of the alignment. For example, to avoid or minimize impacts in sensitive areas, alignment plans and profiles could be adjusted, or proposed structures could be constructed above grade or in tunnels. In addition, construction of wildlife underpasses, bridges, and/or large culverts, could be considered to facilitate known wildlife movement corridors. Removal of embankments and/or replacement of existing bridge structures over lagoons could improve the existing condition by increasing water circulation and tidal influence.

Special mitigation needs would be considered in the future with the appropriate authorities that are responsible for regional mitigation (conservation) banks, HCPs, NCCPs, or special area management plans. Mitigation may include consideration of acquisition, preservation, or restoration of habitats, or relocation of sensitive plant species. Specific mitigation measures would be identified at the project level of environmental review.

Consultation with the appropriate resource agencies to develop site-specific avoidance and minimization strategies would be incorporated in the project-level environmental review.

Resource agencies in the LOSSAN region have expressed interest in helping to develop and participate in a mitigation planning and monitoring program to determine impacts and mitigation effectiveness for sensitive species in the lagoon areas. This approach could include establishing site-specific baseline conditions, monitoring mitigation effectiveness as various proposed projects (highway and rail) are constructed, and adjusting mitigation measures as needed based on effectiveness and compatibility with lagoon restoration programs.

3.13.5 Subsequent Analysis

Identification of potential impacts on various biological resources for this Program EIR/EIS has primarily relied on the available GIS database, other GIS tools, and review of available literature. These sources encompass a broad range of information that may not exactly correspond to actual field conditions. Project-level studies would be required to obtain more reliable assessments of potential impacts on biological resources in the study area.

The subsequent biological resources analyses required for project environmental documentation would focus on project-specific impacts that reflect more precise definitions of the right-of-way, the proposed improvement locations, and the operations. Areas of possible further study include the following.

- Field surveys to determine the extent and type of general and sensitive biological resources, including focused surveys following resource agency protocols for special-status species.
- Mapping of plant communities and sensitive biological resources within and adjacent to the proposed rail improvement right-of-way/impact footprint to address direct and indirect impacts on biological resources.
- Delineation of waters and wetlands to determine the extent of USACE and CDFG jurisdiction, and consultation conducted with these agencies regarding appropriate mitigation.
- Hydraulic analysis of lagoon crossings to identify potentially feasible improvements that may help improve tidal hydraulics and remove barriers to floodwaters.
- Consultation with USFWS, as needed, for potential impacts on federally listed plant and wildlife species, including the preparation of a biological assessment or assessments, and biological opinions for each phase of project implementation. Early consultation would help to refine appropriate mitigation strategies.
- Consultation with CDFG regarding potential impacts on state-listed plant and wildlife species and appropriate mitigation for such impacts. Early consultation would help to refine appropriate mitigation strategies.
- Preparation of an Essential Fish Habitat Assessment.
- Assessment of potential for participation in HCPs.
- Development of a mitigation-monitoring plan for environmental compliance during construction.
- Application for necessary permits (USACE Nationwide Permit or Section 404, USFWS Biological Opinion, CDFG consistency determination with USFWS Biological Opinion, Coastal Zone Development Permit, and 1600 Streambed Alteration Agreement, RWQCB Section 401).

3.14 SECTION 4(f) AND 6(f) RESOURCES (PUBLIC PARKS AND RECREATION)

Section 4(f) and 6(f) resources analyzed in this Program EIR/EIS include publicly owned parklands, recreation lands, wildlife and waterfowl refuges, and historic sites that are covered by Section 4(f) of the Department of Transportation (DOT) Act of 1966 and Section 6(f) of the Land and Water Conservation Fund Act of 1965. This section describes the existing Section 4(f) and 6(f) resources within the project region and identifies the potential uses of and potential impacts on Section 4(f) and 6(f) resources for each alternative. Because this is a program-level environmental document, the uses of and impacts on Section 4(f) and 6(f) resources are analyzed at a program level.

3.14.1 Regulatory Requirements and Methods of Evaluation

A. REGULATORY REQUIREMENTS

Section 4(f)

Section 4(f) of DOT Act of 1966 (49 U.S.C. § 303) states the following.

(a) It is the policy of the United States Government that special effort is made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites.

(b) The Secretary of Transportation shall cooperate and consult with the Secretaries of the Interior, Housing and Urban Development, and Agriculture, and with the States, in developing transportation plans and programs that include measures to maintain or enhance the natural beauty of lands crossed by transportation activities or facilities.

(c) The Secretary may approve a transportation program or project (other than any project for a park road or roadway under section 204 of title 23) requiring the use of publicly owned land of a public park, recreation area or wildlife and waterfowl refuge of national State or local officials, or land of an historic site of national, State, or local significance (as determined by the Federal State, or local officials having jurisdiction over the park, area refuge, or site) only if,

   (1) there is no prudent and feasible alternative to using that land; and

   (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge or historic site resulting from the use.

Similarly, California law requires a state agency that proposes a project which may result in adverse effects on historical resources listed or eligible for listing in the National Register of Historic Places (NHRP) or the California Register of Historical Resources (CRHR) to consult with the State Historic Preservation Office and to identify feasible and prudent measures that will eliminate or mitigate the adverse effects (California Public Resources Code §§ 5024 and 5024.5; CEQA Guidelines § 15064.5).

Section 6(f)

State and local governments often obtain grants through the Land and Water Conservation Fund Act to acquire or make improvements to parks and recreation areas (16 U.S.C. §§ 460-4 through 460-11, September 3, 1964, as amended 1965, 1968, 1970, 1972–1974, 1976–1981, 1983, 1986, 1987, 1990, 1991, 1993–1996). Section 6(f) of the act prohibits the conversion to a non-recreational purpose of property acquired or developed with these grants without the approval of the Department of the Interior's (DOI's) National Park Service. Section 6(f) directs DOI to ensure that replacement lands of equal value (monetary), location, and usefulness are provided as conditions to such conversions. Consequently, where such conversions of Section 6(f) lands are proposed for transportation projects, replacement lands must be provided.

California statutes similarly require replacement lands. The California Public Park Preservation Act of 1971 (California Public Resources Code § 5400 et seq.) provides that a public agency that acquires public parkland for non-park use must either pay compensation that is sufficient to acquire substantially equivalent substitute parkland or provide substitute parkland of comparable characteristics.

A. METHOD OF EVALUATION OF IMPACTS

This evaluation of potential impacts on Section 4(f) and 6(f) resources focuses on identifying uses of historical, cultural, parkland, and wildlife resources under existing conditions, and potential uses of and impacts on these resources under the No-Project and Rail Improvements Alternatives. For this program document, the primary goal of the analysis was the identification of Section 4(f) and 6(f) resources on or very close to the proposed Rail Improvements alignment options and the relative potential impacts of the alignments on these resources. At this stage, it is not practical to study and measure the severity of each potential impact identified. No fieldwork was conducted as part of this analysis. In subsequent project-level analysis, should a decision be made to proceed with the Rail Improvements Alternative, Section 4(f) and 6(f) resources, potential uses and impacts, and appropriate mitigation measures would be identified in detail.

Various sources were consulted to identify potential resources in the LOSSAN region, including available databases, studies, and other documents. These documents are listed in the references chapter of this document. To identify and quantify the potential impacts by resource type, the improvements included under each alignment option were overlaid on available databases and maps.

Two types of potential impacts on Section 4(f) and 6(f) resources were identified: direct and proximity.

- **Direct Impact:** A physical feature of a proposed improvement would directly intersect with a portion or all of the resource and require the use of property from that resource.
- **Proximity Impact:** A physical feature of a proposed improvement has the potential to impact the resource as a result of its proximity to the resource.

Potential impacts were assigned a qualitative ranking of high, medium, or low based on the proximity of the resource to the centerline of the proposed improvement. The rankings are summarized in Table 3.14-1.

Table 3.14-1
Rankings for Potential Direct and Proximity Impacts on Section 4(f) and 6(f) Resources

Ranking	Distance of Resource from Centerline	Potential Impact
High	0 to 150 ft (0 to 46 m)	Direct
Medium	150 to 450 ft (46 to 137 m)	Proximity
Low	450 to 900 ft (137 to 274 m)	Proximity

3.14.2 Affected Environment

A. STUDY AREA DEFINED

The study area for the analysis of Section 4(f) and 6(f) resources encompasses the area within 900 ft (274 m) on either side of the centerline of each alignment and within a 900-ft (274-m) radius of existing and proposed stations.

Because the proposed Rail Improvements Alternative would cross urbanized and developed areas, a variety of Section 4(f) and 6(f) resources could be affected. The proposed alignment options were developed with the intent of avoiding these resources to the extent feasible. There are potential locations within the proposed Rail Improvements Alternatives, however, where Section 4(f) and 6(f) resources would not be avoided. These are discussed in the environmental consequences section below.

B. GENERAL DESCRIPTION OF SECTION 4(f) AND 6(f) RESOURCES

Section 4(f) and 6(f) resources refer to publicly owned lands of a park, recreation area, or wildlife and waterfowl refuge; or land of a historic site of national, state, or local significance (as determined by the federal, state, regional, or local officials having jurisdiction over the park, recreation area, refuge, or site).

Historically, urban and suburban development follows the establishment of transportation corridors and facilities. In California in the late 19th and early 20th centuries, most cities formed around ports and rail lines, the primary modes for transporting people and goods. After World War II, in the early 1950s, highways and the automobile became the dominant mode of transportation, bringing urban and suburban development to areas along highways that were formerly farm-to-market roads connecting rural areas to cities.

The location and identification of Section 4(f) and 6(f) resources reflect this historic transportation corridor and urban development pattern. Today, in the urban areas that developed around the railroads at the turn of the century, there is a high concentration of historical resources. In many southern California cities the railroad station is one of the oldest historical resources in the city. In the suburban and rural areas where development followed highways, some open space and natural areas have been preserved as public parks. In addition to these passive park[1] areas, new public parks

1 *Passive park* refers to a park that is used for picnicking or passive water sports; it also describes zoos and arboretums. An *active park* is a park that includes facilities such as children's play equipment, playing fields, tennis or basketball courts, etc.

and playgrounds have been built as part of residential developments. All of these historical resources and public parks are considered potential Section 4(f) and 6(f) resources. Therefore, in urban areas an alternative would be more likely to affect historical and archeological resources, while in suburban, wilderness, or open space or natural areas (e.g., lagoons) an alternative would be more likely to affect public parks and recreation lands, and wildlife and waterfowl refuges.

C. SECTION 4(f) AND 6(f) RESOURCES IN THE STUDY AREA

The most significant Section 4(f) and 6(f) resources in the LOSSAN region (except historical and archaeological resources) are identified below. (See Section 3.12, Cultural and Paleontological Resources, for an analysis of historical and archeological resources.) The project area includes the western portion of the Los Angeles basin and the coastal areas of southern California between Los Angeles and San Diego, generally following the existing LOSSAN rail corridor. The Section 4(f) and 6(f) resources in the project area are predominantly local and regional parks. However, this region includes older coastal cities, and several areas have a high number of historic properties listed on the NRHP and the CRHR.

In addition to local and regional parks, the study area encompasses ten state beaches that are Section 4(f) or 6(f) resources (San Onofre, San Clemente, Doheny, Leucadia, Carlsbad, South Carlsbad, Moonlight, Cardiff, San Elijo, and Torrey Pines). Several areas associated with lagoons are also 4(f) resources in the study area, including Batiquitos Lagoon Ecological Reserve, San Elijo Lagoon Ecological Reserve, and San Dieguito Lagoon Ecological Preserve. Military facilities, including the El Toro Marine Corps Air Station, Camp Pendleton, and the Miramar Naval Reservation, are also 4(f) resources in the study area.

Specific Section 4(f) and 6(f) resources within the study area are listed by rail segment in Appendix 3.14-A.

The Coastal Rail Trail (CRT), an approved project within San Diego County, will be located along an alignment parallel to and either within or adjacent to the existing LOSSAN rail right-of-way. The CRT is currently in various stages of implementation, with some segments already completed and in use. The CRT is mainly used for transportation purposes, with incidental use for public recreational activities including, but not limited to, landscaping, cycling, jogging, and walking. Because transportation is the primary use definition and recreational activities are incidental, Section 4(f) resource protections would not apply to the CRT.

3.14.3 Environmental Consequences

The identification of Section 4(f) and 6(f) resources could result in significant differences among the alignment options, because of the potential disruptions and costs associated with the avoidance, minimization, and possible need to mitigate impacts on such resources. These impacts could range from temporary construction impacts to the acquisition of Section 4(f) and 6(f) resources.

A. EXISTING CONDITIONS COMPARED TO NO PROJECT ALTERNATIVE

The existing conditions are based on transportation infrastructure that was identified as part of the alternatives definition process. The No Project Alternative is based on existing conditions and the funded and programmed transportation improvements that are projected to be developed and in operation by 2020. It is not possible as part of this study to identify or quantify the potential uses and impacts expected to occur by 2020 with implementation of the No Project Alternative. Rather, it is assumed that the improvements to be developed and implemented under the No Project Alternative would undergo typical design and construction practices that would avoid or greatly limit potential impacts. Additionally, each improvement associated with the No Project Alternative will be subject to a project-level environmental document that will identify potential uses and impacts, as well as measures to avoid, minimize, or mitigate the impacts. Thus, no impacts are quantified under the No Project Alternative.

B. NO PROJECT ALTERNATIVE COMPARED TO RAIL IMPROVEMENTS ALTERNATIVE

The No Project Alternative is the assumed 2020 condition, as described above. Any potential impacts associated with the Rail Improvements Alternative would occur in addition to the impacts associated with the No Project Alternative. For this analysis, the difference in impacts between the Rail Improvements Alternative relative to No Project (existing conditions in this case) are compared.

A majority of the proposed Rail Improvements alignment options would be within the existing LOSSAN rail right-of-way. However, the potential for impacts to known and potential historical and archeological resources is high in a number of these areas, primarily because these resources are generally located in urban centers where the range of possible alignment options is limited. (A detailed analysis of historical and archeological resources is found in Section 3.12, *Cultural and Paleontological Resources*.)

The Section 4(f) and 6(f) resources identified in the LOSSAN region are primarily local and regional parks, state beaches, several ecological preserves, and military facilities. Although construction of the Rail Improvements Alternative is expected to occur within 150 ft (46 m) of some parks and refuge lands, the majority of the activities would be within the existing LOSSAN rail corridor. The railroad was originally constructed in the 1800s, before most parks and conservation lands were established around it. Because most alignment options would be within existing rail or roadway corridors, the potential for impacts would be temporary or could be reduced by mitigation strategies.

Tunneling options in several rail segments could reduce or avoid impacts on some of the Section 4(f) and 6(f) resources. Because tunneling could result in the removal of existing aboveground track, new parklands could potentially be created for public use, which would result in beneficial impacts on Section 4(f) and 6(f) properties. Specific areas where this could occur include the Del Mar Bluffs area, the San Clemente coastal area, and the San Juan Capistrano area. This would need to be evaluated in detail during project-level studies.

Table 3.14.2 summarizes the number of potential high impacts (that is, direct impacts within 150 ft [46m] of the centerline of an alignment option) for the Rail Improvements alignment options. Specific Section 4(f) and 6(f) resources are listed in Appendix 3.14-A.

In comparing alignment options in the same rail segments, there is little or no difference in the number of Section 4(f) and 6(f) resources that are within 150 ft (46 m) of the proposed improvements. Where a tunnel option exists, that option would avoid most if not all potential impacts.

Table 3.14-2
Summary of 4(f)/6(f) Resources Potentially Affected in Study Area

Rail Improvements Alignment Options	Potential High[1] Impacts on Section 4(f) Resources)	Potential High[1] Impacts on Section 6(f) Resources	Total Potential High[1] Impacts
Union Station To Fullerton Station – 4th Main Track	4	0	4
Fullerton Station To Irvine Station--Double Tracking			
AT-GRADE between Orange and Santa Ana	3	0	3
TRENCH between Orange and Santa Ana	3	0	3
Stations Fullerton	0	0	0
Anaheim	0	0	0
Santa Ana	0	0	0
Irvine	1	0	1
San Juan Capistrano Double Tracking			
TUNNEL along I-5 between Hwy 73 and Avenida Aeropuerto	1	0	1
AT-GRADE and Cut/Cover TRENCH along east side of Trabuco Creek	1	0	1
Stations San Juan Capistrano	0	0	0
Dana Point/San Clemente Double Tracking			
Dana Point Curve Realignment; San Clemente - SHORT TUNNEL	5	1	6
San Clemente - LONG TWO-SEGMENT TUNNEL	4	1	5
Stations San Clemente	0	0	0

Table 3.14-2
Summary of 4(f)/6(f) Resources Potentially Affected in Study Area (continued)

Rail Improvements Alignment Options	Potential High[1] Impacts on Section 4(f) Resources)	Potential High[1] Impacts on Section 6(f) Resources	Total Potential High[1] Impacts
Camp Pendleton At-grade Double Tracking	2	0	2
Oceanside/Carlsbad Double Tracking			
Carlsbad - AT-GRADE; double tracking	3	0	3
Carlsbad -TRENCH; double-tracking	3	0	3
Stations Oceanside	0	0	0
Encinitas/Solana Beach Double Tracking			
Encinitas - AT-GRADE;	2	1	3
Encinitas - SHORT TRENCH	2	1	3
Stations Solana Beach	0	0	0
Del Mar Double Tracking			
TUNNEL under Camino Del Mar	3	0	3
TUNNEL along I-5	2	0	2
I-5/805 Split To Hwy 52 Double Tracking			
Miramar Hill TUNNEL	2	0	2
I-5 TUNNEL	3	0	3
Stations UTC (Only applies to Miramar Hill Tunnel)	1	0	1
Hwy 52 To Santa Fe Depot Curve realignment and Double Tracking	3	0	3
Stations Santa Fe Depot	0	0	0

[1]: High impacts assume resource is located within 150 ft (46m) of improvement centerline. Potential impacts on historical and archaeological resources are not included here because they are discussed in detail in Section 3.10.

3.14.4 Impact Avoidance Strategies, Including Alternatives Screened from Further Consideration

Throughout the environmental review process, the Department has emphasized minimizing harm to the environment. One of the Department's policies, as stated in Chapter 1, is "to maximize the use of existing transportation corridors and right-of-way, to the extent feasible." This policy is one of the primary impact avoidance strategies for the proposed Rail Improvements Alternative. This policy and the other goals implicit in the project purpose and need were used in the scoping process and successive screening stages of the program environmental process (see Chapter 2, *Alternatives*). The screening evaluation considered the potential impacts of the various alignments and all the environmental parameters, including impacts on Section 4(f) and 6(f) resources. The Department and the FRA developed the screening recommendations, with input from federal cooperating agencies; state, regional, and local agencies; and members of the public.

3.14.5 Avoidance Alternatives or Reasons for No Prudent or Feasible Alternative for Use of Section 4(f) or 6(f) Resource

Direct impacts on many Section 4(f) and 6(f) resources could be avoided by remaining within existing railroad right-of-way, or moving horizontally within the right-of-way, where feasible. Avoidance of Section 4(f) and 6(f) resources would be explored during project-specific design and environmental evaluation. Project-level evaluations of Section 4(f) and 6(f) resource use would include documentation of the avoidance alternatives and/or reasons for no prudent or feasible alternative for impacts on Section 4(f) and 6(f) resources for the segments being studied.

There are several potential Section 4(f) and 6(f) recreation resources and cultural resources within or immediately adjacent to the proposed alignments. Avoidance of these resources would be possible in many cases by redesigning or narrowing the disturbance limits, in combination with noise walls and/or visual screening. However, there may be locations where avoidance could not be achieved, possibly for one of more of the following reasons.

- Shifting the centerline (and the whole facility) to avoid one or more resources could result in greater potential impacts on other resources.
- The alignment options cannot be shifted easily because of the large turning radii required for rail operations and other design considerations. A minor shift in one location on the rail alignment could result in a substantial shift elsewhere on the alignment, potentially resulting in impacts on other Section 4(f) and 6(f) resources.
- Measures to reduce potential proximity impacts, such as noise walls, could result in potential adverse visual impacts on Section 4(f) and 6(f) resources. Potential measures to minimize harm at each resource need to be analyzed in consultation with the owners of the resources to ensure that measures to minimize harm do not adversely affect the values of the Section 4(f) and 6(f) resources.

3.14.6 Mitigation Strategies

Possible mitigation measures for impacts on Section 4(f) and 6(f) resources include sound walls, visual buffers/landscaping, and modification of transportation access to/egress from the resource. Some of these measures could include design modifications or controls on construction schedules, phasing, and activities. Planning efforts would be undertaken as a part of the project-level documentation phase to minimize harm to the Section 4(f) and 6(f) protected resources. This is anticipated to include measures that may be taken to mitigate potential adverse environmental impacts, such as beautification measures, replacement of land or structures or their equivalents on or near their existing site(s), tunneling, cut and cover, cut and fill, treatment of embankments, planting, screening, creating wildlife corridors, acquisition of land for preservation, installation of noise barriers, and establishment of pedestrian or bicycle paths. Other potential mitigation strategies could be discovered with public input.

3.14.7 Subsequent Analysis

The Section 4(f) and 6(f) evaluation process would continue at the project-specific level. Given the broad focus of analysis for this Program EIR/EIS, the primary goal for project-level analysis would be to identify Section 4(f) and 6(f) resources and potential impacts in greater detail, to identify the existence of potential prudent and feasible alternatives, and to identify and analyze potential mitigation measures.

The following items would be included in the Section 4(f) and 6(f) evaluations at the project level.

- Detailed physical descriptions of a specific portion of the proposed Rail Improvements alignment (including plans and profiles).
- Updated list of all Section 4(f) and 6(f) recreation resources in proximity to the proposed alignment centerlines and project components, using the most recent mapping available such as annually updated Thomas Bros. maps, general plans, state Web sites, local jurisdiction Web sites, etc.
- Updated list of NRHP-listed and NRHP-eligible cultural resources. As part of detailed cultural resources studies required for project-level environmental review (see Section 3.10.7), all previously identified potentially eligible resources would be further evaluated to determine NRHP eligibility. NRHP-eligible resources would be carried forward to the project-level Section 4(f) and 6(f) evaluation. Field reconnaissance would be needed to complete the required Section 4(f) inventory sheets.
- List of the CRHR-listed and eligible resources and field reconnaissance to provide a complete inventory and description of these resources.
- Descriptions of uses and functions of each Section 4(f) and 6(f) resource, including location map; size; services and facilities; annual patronage; unique qualities; relationship to other lands in the project vicinity; owner/operator; other relevant information regarding the resource; and explanation of the significance of the properties as determined by federal, state, regional, or local officials with jurisdiction over the resource.
- Detailed descriptions of the proposed uses of and potential impacts on Section 4(f) and 6(f) resources and of the methods used to identify them. Specific potential impacts on each resource would be identified, including proximity impacts as a result of impacts on ambient noise, air quality, transportation, and visual resources.
- Identification and refinement of strategies to avoid or minimize use of and impacts on Section 4(f) and 6(f) resources by narrowing rights-of-way/disturbance limits, realigning/

relocating project features, and developing other alignment adjustments. These strategies would analyze, as appropriate, the technical feasibility, including cost estimates with figures showing percentage differences in total project costs, possibility of community or ecosystem disruption, and other potential significant adverse environmental impacts of each alternative; and show the financial, social, or ecological costs or potential adverse environmental impacts of each alternative, as well as unique problems and extraordinary magnitudes of impacts.

- Documentation of consultation with the affected local jurisdictions and owners/operators of the identified Section 4(f) and 6(f) resources. This would include documentation of concurrence or efforts to obtain concurrence from the public official or officials having jurisdiction over the Section 4(f) and 6(f) resources and documentation of the planning to minimize harm to the affected resources. (Refer to Chapter 8, *Persons and Organizations Contacted*, for additional discussion of these consultations.) In addition to the mitigation proposed, the Section 4(f) and 6(f) evaluation should document the National Park Service's tentative position relative to any proposed Section 6(f) conversion and should address the need for replacement lands under federal and California law (Federal Highway Administration 1987).

3.15 GROWTH INDUCEMENT

Transportation investments can lead to reduced travel time or cost, improved accessibility within or among regions, or reduced accidents or air pollution. These effects contribute to economic growth by allowing time and money previously spent on travel to be used for other purposes, attracting businesses and residents to places with increased accessibility or improved quality of life, and reducing overall costs to society. The population and employment growth that result comprise the *growth-inducing effects* of transportation investments. This growth can contribute to additional impacts beyond those directly attributable to the changes in the transportation system. These effects are known as *indirect effects*.

CEQA requires that the growth-inducing impact of a proposed project be discussed in the EIR. CEQA Guidelines (§15126) state that the EIR shall "…discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment."

This section addresses the potential for growth inducement and related impacts from the No Project Alternative and from the construction and operation of the proposed Rail Improvement Alternative.

3.15.1 No Project Alternative

The No Project Alternative would not have any growth-inducing impacts on the LOSSAN region. The highway and rail improvement projects that are programmed to be completed by 2020 under the No Project Alternative would help to accommodate existing and projected travel demands rising out of the population growth over the next 20 years.

3.15.2 Rail Improvements Alternative

A. OPERATIONAL IMPACTS

The proposed Rail Improvements Alternative would not introduce a new rail corridor into the region. Based on population and employment forecasts for the LOSSAN region[1], the number of passenger trains in the LOSSAN corridor is projected to double between 2003 and 2020, increasing from an average of 71 trains per weekday in 2003 to 140 trains per weekday in 2020. During this same time period, freight trains in the corridor are projected to increase from approximately 45 to 99 per day between Union Station and Fullerton (then east out of the LOSSAN region), and from 7 to 11 per day between Fullerton and San Diego[2].

The increases in passenger and freight trains on the LOSSAN corridor are projected to occur as a result of increased population and employment in the region. The population in the LOSSAN region (defined as Los Angeles, Orange, and San Diego counties) is projected to increase 23 percent between 2000 and 2020, from 13.8 million to 18.6 million (SCAG 2001; SANDAG 2002). The growth of the region, and the resultant increased demand for passenger and freight service, would occur with or without the

[1] Amtrak 2020 projections based on Amtrak "California Passenger Rail Plan System 20 Year Improvement Plan" (200?); Metrolink 2020 projections based on SCRRA 30 year Strategic Plan (2000); NCTD 2020 projections based on SANDAG Regional Transportation Plan (2003).

[2] BNSF 2020 projections based on LAEDC Growth Rate Projections, July 2002 for the LA to Fullerton Segment; SANDAG 2020 population and employment forecasts for the Oceanside to San Diego Segment.

proposed rail improvements. Therefore, the Rail Improvements Alternative would not create growth, and would not have any discernible effect on projected growth in the LOSSAN region. The project would help to accommodate the existing and projected intercity travel demand between Los Angeles and San Diego by increasing the capacity and reliability of the existing rail service.

Implementation of the Rail Improvements Alternative could have some localized effects on the type of development that may occur around station areas. The majority of stations along the LOSSAN corridor would remain in their existing location, with only parking expansion and bypass tracks proposed as part of the Rail Improvements Alternative. At those stations, there would not be any change in the type of surrounding development, and a change in the density of development is not likely because the station areas are already developed or would be developed according to local land use plans.

There are several stations that could be added to the system as part of certain rail improvement alignment options. These include potential new stations in San Juan Capistrano (Trabuco Creek option only), San Clemente, and University Towne Centre (Miramar Tunnel option only). These potential station sites are in developed, mixed-use commercial/residential areas. The presence of a new rail station could increase the rate of development, or change the types of establishments that develop. Overall, the impacts of such changes would be small, given the existing and planned land uses in these suburban areas.

There would be incremental growth in the number of railroad employees for operations and maintenance between now and 2020. This growth would be caused by the projected increase in train traffic along the LOSSAN corridor, and would not be attributable to the proposed rail improvements. It is reasonable to expect that the additional employees would be drawn from regional employment pool, and would not cause an influx of workers that would require additional housing or public services.

B. CONSTRUCTION IMPACTS

The Rail Improvements Alternative, if carried forward, would be implemented incrementally over the next 20 years. The construction period for any particular improvement project could vary from approximately one year or less (for short distances of at-grade double tracking) to multiple years (for long tunnels). Because individual projects within the corridor would be phased, it is expected that each construction effort would be small enough that workers could readily be drawn from the available regional work force. It is unlikely that any phase would require an influx of workers from outside the region, so no increase in housing or public services would be required to accommodate the work force. No significant growth in employment is expected to result from construction of the proposed project.

3.16 CUMULATIVE IMPACTS EVALUATION

3.16.1 Introduction to Cumulative Impacts

This section describes the potential cumulative impacts of the No Project and Rail Improvements Alternatives in the study area analyzed in this Program EIR/EIS. Cumulative impacts can result from individually minor but collectively significant impacts of all projects/actions in the study area taking place over a period of time. Cumulative impacts include direct and indirect effects of proposed projects/actions that result from incremental impacts of the proposed project/action added to the impacts of other past, present, and reasonably foreseeable projects/actions, regardless of what agency or person undertakes such projects or actions (40 C.F.R. § 1508.8; 14 C.C.R. § 15130).

The term *cumulative impact* refers to “two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts” (CEQA Guidelines § 15355). A cumulative impact can result from either of the following.

- The combination of two or more individually significant impacts.
- The combination of two or more impacts that are individually less than significant but constitute a significant change in the environment when considered together.

To analyze a proposed project’s contribution to cumulative impacts, a lead agency must identify reasonably foreseeable projects/actions in the vicinity of the proposed project, summarize their effects, identify the contribution of the proposed project to cumulative impacts in the project region, and recommend feasible options for mitigating or avoiding the project’s contribution to any significant cumulative effects (CEQA Guidelines § 15130[b][3]).

There are two approaches to identifying related past, present, and future projects and their impacts: the “list” approach, where projects are identified on an individual basis, and the “projection” approach, where the analysis of cumulative impacts is based on a summary of projections in an adopted general plan or related planning document. In this Program EIS/EIR, both approaches have been used. For this Program EIR/EIS, information was used from existing environmental documents completed for regional transportation plans that include the highway and rail improvement projects approved for future implementation under the No Project Alternative (No Project) and projections made in the state implementation plan for air quality. The list of these projects is included in Chapter 2, *Alternatives*, Table 2.4.2-1. To capture potential indirect cumulative effects, this cumulative impacts section also addresses highway improvements and transit projects within the study area and within the same areas of potential effect evaluated for the specific corridors included as part of the No Project and Rail Improvement Alternative alignments. The projects considered herein are primarily transportation-related (e.g., highway and rail transit improvements) and are based on planned improvements that are included as part of the fiscally unconstrained (not programmed at present) portion of the regional transportation plans for each region in the study area. Appendix 3.16-A lists the projects identified for consideration in this cumulative impact analysis.

Potential cumulative impacts are discussed separately for each environmental topic as appropriate for a program-level environmental analysis.

3.16.2 Cumulative Impacts Analysis

The following analysis describes the potential for the Rail Improvements Alternative to contribute to cumulative impacts under each environmental topic. The environmental topics are discussed herein in the same order as they appear in Chapter 3. The No Project Alternative is mentioned only when there are potential cumulative impacts that would result from not proceeding with the Rail Improvements Alternative (examples: geology and soils, noise). Where the No Project Alternative would not result in impacts by 2020, or where the existing conditions would not change (or conditions were considered too speculative to feasibly predict for future years), the No Project Alternative is not addressed. The No Project Alternative is not addressed in Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice; Public Utilities; Hazardous Materials and Wastes; Cultural and Paleontological Resources; Hydrology and Water Resources; Biological Resources and Wetlands, and Section 4(f) and 6(f) Resources (Public Parks and Recreational Resources).

A. TRAFFIC AND CIRCULATION AND TRAVEL CONDITIONS

As stated in Chapter 1, *Purpose and Need*, intercity travel in southern California is expected to grow from 36 million trips, in 1997, to more than 47 million trips by 2020, with an estimated 98% of these intercity trips made by automobile within the study area. All but one of the 8 highway segments analyzed in this study would operate at unacceptable conditions (level of service F) under the No Project Alternative. The expected increase in the number of autos on the highways by 2020 would also result in significant travel delays and congestion under No Project, which would have significant potential impacts on the regional and statewide economy and quality of life.

Implementation of the proposed Rail Improvements Alternative would result in a more reliable and safe travel mode option and could help to reduce passenger trips by automobile. This outcome would benefit intercity highways and would potentially reduce travel delays on the affected highways and on surface streets leading to and from intercity highways. Localized traffic conditions around some rail stations would experience a decrease in level of service and some added delays, and transit lines serving the stations areas could experience increases in passengers during peak hours. Although these potential effects could contribute to localized cumulative impacts, they could be mitigated, and any potential contribution to cumulative impacts could be minimized. Site-specific traffic analysis would be part of subsequent evaluation of local impacts around station locations if a decision is made to pursue the Rail Improvement Alternative.

B. AIR QUALITY

The analysis of air quality considers emissions projected by the California Air Resources Board (CARB) for eight criteria pollutants (CO, SO_x, HC, NO_x, O_3, PM_{10}, $PM_{2.5}$, and Pb) in the two air basins potentially affected, and therefore, includes all reasonably foreseeable project/actions and population growth as part of the No Project Alternative. The analysis is structured to estimate the potential impacts on the air quality on the local and regional levels in the two air basins directly affected by the project alternatives, South Coast and San Diego. Overall, the potential impacts of either the No Project or Rail Improvement Alternative, in combination with the air quality impacts of other highway and rail projects identified for this cumulative impact analysis (Appendix 3.16-A) and those projects considered in the state implementation plan for air quality could contribute to cumulative air quality impacts within the two-basin study area.

Air emissions from locomotive travel in the LOSSAN corridor would be the same under either the No Project or the Rail Improvements Alternative because train travel in the corridor is projected to nearly double by 2020, with or without the proposed improvements. Under either alternative, annual emissions from locomotives in the year 2020 would be approximately 444 tons of CO; 81 tons of PM; 2,284 tons of NO_x; and 123 tons on TOG.

The Rail Improvements Alternative would reduce train congestion and delays along the corridor, and the amount of locomotive idling time associated with delays and bottlenecks. Proposed grade separations would reduce vehicular delays and idling at grade crossings throughout the corridor. These benefits would decrease the cumulative contribution of locomotive and vehicular emissions along this travel corridor.

Construction of rail improvements would contribute to short-term cumulative PM emissions from construction equipment and fugitive dust. Both air basins are nonattainment for PM_{10} so this contribution could be potentially significant. PM emissions could be reduced with mitigation prescribed by state and local guidelines.

C. NOISE AND VIBRATION

Noise, particularly in growing urban areas and along highway and rail corridors, will continue to increase as population grows and use of highways, rail, and airports increases.

The Rail Improvements Alternative has the potential to cause high noise impacts along approximately 20 mi (32 km) of the corridor, between Fullerton and Irvine. These potential impacts, when combined with the potential noise impacts of other highway, roadway, and transit expansion projects in the region, would contribute to localized potential cumulative noise impacts during construction and operation.

D. ENERGY

Energy consumption from the number of locomotives traveling in the LOSSAN corridor would be the same under either the No Project or the Rail Improvements Alternative because train travel in the corridor is projected to nearly double by 2020, with or without the proposed improvements. Under either alternative, annual operational (direct) energy use by locomotives in the year 2020 would be approximately 361,922 barrels of oil.

The Rail Improvements Alternative would reduce train congestion and delays along the corridor, and the amount of locomotive idling time associated with delays and bottlenecks. Proposed grade separations would reduce vehicular delays and idling at grade crossings throughout the corridor. These benefits would increase fuel efficiency and decrease the cumulative energy consumption of locomotives and on-road vehicles along this travel corridor.

Construction of rail improvements would consume on the order of 14,066 billion Btus. This, along with energy consumed by other transportation and development construction in the region, would potentially represent a significant cumulative use of nonrenewable resources.

E. LAND USE AND PLANNING, COMMUNITIES AND NEIGHBORHOODS, PROPERTY, AND ENVIRONMENTAL JUSTICE

The proposed Rail Improvements Alternative would contribute to potential cumulative impacts associated with community and neighborhood cohesion and property loss. Some alignment options would exacerbate existing barrier effects of the LOSSAN rail corridor by double tracking at grade. Combined with other transit (light rail and commuter rail) and roadway projects considered for this cumulative impact analysis, as listed in Appendix 3.16- A, these localized impacts would contribute to cumulative community/neighborhood impacts. Other alignment options would improve existing conditions by removing the barrier with below-grade double tracking or tunneling. Under the Rail Improvements Alternative, between about 5 and 7 mi (8 and 11 km) of rail alignment and station improvements (4% to 6% of total alignment distance) has a high potential to impact land uses (new corridor in residential areas), and between 5 and 10 mi (8 and 16 km) of track alignment (4% to 8% of alignment distance) has a medium potential to impact land uses (widening existing corridors in residential and commercial business areas). These impacts, in combination with other transit extension and roadway projects, would contribute to potential cumulative impacts on various property types, neighborhoods, and communities.

F. AESTHETICS AND VISUAL RESOURCES

The aesthetic and visual quality analysis focused on potential impacts on visual resources (particularly scenic resources, areas of historic interest, natural open space areas, and significant ecological areas) along the proposed alignments for the Rail Improvements Alternative and around expanded or potential rail station sites. The Rail Improvements Alternative would impact existing visual quality and would contribute to potential cumulative impacts on aesthetics and visual quality throughout the study area for visual resources (0.25 mi [0.40 km] from the centerline of proposed alignment options and around stations).

The proposed Rail Improvements Alternative would contribute to both short- and long-term potential cumulative impacts on visual resources. Construction of the proposed improvements would have short-term potential impacts on visual resources. Construction equipment, staging areas with construction materials, signage, and night lighting would be visible from adjacent properties and roadways during the construction period. The number of years such disruptions would continue could be about 10 to 15 years corridor-wide; however, potentially a few months to two years for most local areas. Thus the Rail Improvement Alternative could contribute to construction-related cumulative impacts on visual resources.

Long-term visual changes would result from: The track, fencing along open trenches, sound walls (if included), elevated structures (where included), and trains themselves that would introduce a linear element into the landscape that would contribute to potential cumulative visual impacts when considered with the strong linear element of the existing highway and transmission lines that the rail corridor parallels. The significance of the visual change would vary by location, depending on the sensitivity of the landscape and the compatibility with existing landscape features.

In a number of locations the Rail Improvements Alternative would present opportunities to improve the existing visual environment with alignment and/or construction options that would either place existing and new rail infrastructure in a tunnel or covered trench, or remove existing rail infrastructure from areas of high scenic value and relocate it in tunnels. Thus, the improvements would contribute to a beneficial cumulative effect when combined with other planned improvements along the coastal landscape.

The No Project Alternative would contribute to potential cumulative impacts on aesthetics and visual quality in costal beach communities and state beaches. The existing rail corridor would remain in beach/coastal bluff areas in the Dana Point/San Clemente and Del Mar areas, contributing to the cumulative visual impacts to coastal views from residences, beaches, and commercial establishments.

G. PUBLIC UTILITIES

Construction of multiple linear facilities (e.g., highway expansions, rail extensions, pipelines, transmission lines) in the region would potentially contribute to cumulative impacts on public utilities and future land use opportunities because of right-of-way needs and property restrictions associated with these types of improvements. These multiple facilities would place constraints on future development, including future development of public utilities. If the proposed Rail Improvements Alternative is advanced, the next stage of environmental review would emphasize detailed alignment design to avoid potential contribution to cumulative impacts from linear facilities on land use opportunities and to minimize conflicts with existing major fixed public utilities and supporting infrastructure facilities. The potential for cumulative impacts to public utilities would be minimized because the proposed rail improvements would be within the existing LOSSAN corridor or in deep tunnels for most alignment options.

H. HAZARDOUS MATERIALS AND WASTES

Implementation of the proposed Rail Improvements Alternative would not directly or indirectly generate hazardous materials or wastes. Any hazardous wastes encountered through ground-disturbing activities during construction would be handled and disposed of in accordance with regulatory requirements. Therefore, no cumulative hazardous material impacts would result from the Rail Improvement Alternative in combination with other projects.

I. CULTURAL AND PALEONTOLOGICAL RESOURCES

The proposed Rail Improvement Alternative would contribute to potential cumulative impacts on archaeological resources, historical structures, and paleontological resources in the study region. Potential impacts would likely occur in areas that cross formations with paleontological sensitivity and in areas where the alignment options are within the existing rail corridor through urban areas because the corridor tends to be surrounded by historical structures. Urban transportation corridors also tend to have high sensitivity for prehistoric sites that could be impacted by both at-grade and below-grade (trenched) construction. Subsequent field studies to verify the location of cultural resources would offer opportunities to avoid or minimize direct impacts on resources.

J. GEOLOGY AND SOILS

The Rail Improvements Alternative could impact slope stability in locations of cut and fill. Some construction activities, such as placing fill material on top of a slope or performing additional cuts at the toe of a slope, can decrease the stability of the slope. These activities, when combined with similar activities from other projects in the region, could potentially result in cumulative impacts on slope stability in areas susceptible to slope failure.

Pumping or construction dewatering associated with the Rail Improvements Alternative in segments where tunneling or extensive earthwork would be undertaken would potentially impact the ground surface and could result in subsidence at some locations. This could contribute to cumulative impacts if other projects under construction in the area also needed to dewater from the same drainage basin.

The Rail Improvements Alternative would contribute to a cumulative beneficial impact on the coastal bluffs in San Clemente and Del Mar, where proposed alignment options would remove the existing rail line from the bluffs and place them in a tunnel. This would improve the stability problems with the bluffs, and reduce the need for drainage and slope stabilization structures in these areas.

The No Project Alternative would contribute to the cumulative slope instability and drainage issues in these coastal bluff areas. Continued stabilization measures would need to be taken to ensure reliable rail service along the bluffs.

K. HYDROLOGY AND WATER RESOURCES

The proposed Rail Improvements Alternative would contribute to potential cumulative impacts on hydrologic resources. Depending on the alignment options, between 205 and 315 ac (83 and 127 ha) of floodplains, 11,760 and 13650 linear ft (3,528 and 4,095 linear m) of streams, and up to 12 ac (5 ha) of lagoons would be within the vicinity of the improvements, and some of these resources would be directly impacted. Groundwater in the California Coastal Basin Aquifer could also be affected in the northern portion of the study area. The amount of impervious surface associated with the rail improvements would be small because the at-grade alignments would consist of permeable track-fill. Improvements within the existing rail corridor or in tunnels would reduce potential hydrologic impacts Potential cumulative hydrologic impacts could occur in the lagoon areas because of the potential for I-5 widening and rail improvement work to be done within the same timeframe.

The existing hydrologic conditions at lagoons in northern San Diego County may be improved by removal of existing embankments or fill with the construction of replacement causeway or open-cell bridge structures. These actions would increase tidal flow and contribute to a cumulative, beneficial effect on these waters.

L. BIOLOGICAL RESOURCES AND WETLANDS

The analysis of potential impacts on biological resources and wetlands includes sensitive plant communities, sensitive habitats of concern, special-status species, marine and anadromous fish habitat, riparian corridors, wildlife habitats, wildlife movement corridors, jurisdictional wetlands, and waters of the U.S. that would require a permit and Section 404b(1) analysis. The additional land required and the linear features added under the Rail Improvements Alternative would contribute to the potential for cumulative impacts on biological resources and wetlands throughout the project area.

The Rail Improvement Alternative would potentially have temporary and permanent, direct and indirect impacts on sensitive biological resources and wetlands and would contribute to potential cumulative impacts on these resources when combined with other foreseeable projects (Appendix 3.16-A) in the study area. Many of the alignment options would use the existing LOSSAN rail corridor or would be in deep tunnels and would therefore not result in direct disturbance of sensitive habitats. Although there is a potential for cumulative impacts on biological resources from increased noise from the collective projects in the area, the information for assessing this potential additive effect is not considered at this program level of analysis and would be addressed when site-specific analysis is completed in a subsequent phase of evaluation.

The additional right-of-way, and surface and sub-surface disturbance associated with the proposed Rail Improvements Alternative would potentially affect up to 28 ac (11 ha) of sensitive vegetation, 12,564 linear ft (3,830 linear m) to 15,541 linear ft (4,737 linear m) of non-wetland jurisdictional waters, 20 to 27 ac (8 to 11 ha) of wetlands, and 36 to 46 special-status species throughout the study area, depending on the alignment options selected.

The Rail Improvements Alternative would generally be located within or adjacent to existing transportation corridors or would be in tunnels or on elevated causeways or bridges through sensitive habitat areas. During project-level environmental review, field studies would be conducted to verify the location, in relation to the proposed rail alignments, of sensitive habitat, wildlife movement corridors, and wetlands. These studies would provide further opportunities to minimize and avoid potential impacts on biological resources through changes to the alignment plan and profile in sensitive areas. For example, the inclusion of design features such as elevated track structures over drainages and wetland areas would minimize potential impacts to wildlife and sensitive species. However, when combined with the potential impacts of other highway, water, and transit projects in the region, the Rail Improvements Alternative would contribute to potential cumulative impacts on biological resources. The potential for cumulative direct and indirect (noise, light, and shadow effects) impacts on biological resources would be of particular concern in the areas of the tidal lagoons in northern San Diego County, where the widening of Interstate 5 would potentially occur in the same timeframe and in the same lagoon areas as the proposed Rail Improvement Alternative.

M. SECTION 4(f) AND 6(f) RESOURCES (PUBLIC PARKS AND RECREATIONAL RESOURCES)

The proposed Rail Improvements Alternative would contribute to the cumulative impact on parkland resources. The impacts on parkland resources would be minimized because most of the proposed rail improvements would be within the existing rail corridor or in tunnels. Depending on the combination of alignment options selected, the Rail Improvements Alternative could result in potential impacts to parkland resources in 29 to 33 locations along the corridor. During project-level environmental review, field studies would offer the opportunity to avoid or minimize direct or indirect impacts on parklands by making adjustments in the alignment plan or profile. There may also be opportunities to create new parkland resources in areas where the existing LOSSAN rail line would be removed from coastal beach areas and placed in tunnels. This could contribute to a cumulative beneficial increase in the number of parkland resources in the study area.